



IN THE UNITED STATES PATENT  
AND TRADEMARK OFFICE

Group Art Unit 3643  
Examiner Jeffrey L. Gellner

Sean P. Burns et al.

**APPEAL BRIEF**

Application Serial No. 09/638,606

Filed August 15, 2000

For: SELECTIVE NON-CATALYTIC REDUCTION  
(SNCR) OF TOXIC GASEOUS EFFLUENTS  
IN AIRBAG INFLATORS /

April 25, 2007

Sir:

This is an appeal from the final rejection of claims 21, 23, 25, 27, 29, 31 and 34-47 set forth in the office action mailed on September 25, 2006.

**Table Of Contents**

**(i) Real Party In Interest (page 3)**  
**(ii) Related Appeals And Interferences (page 4)**  
**(iii) Status Of Claims (page 5)**  
**(iv) Status Of Amendments (page 6)**  
**(v) Summary Of Claimed Subject Matter (page 7)**  
**(vi) Grounds Of Rejection To Be Reviewed On Appeal (page 10)**  
**(vii) Argument (page 11)**  
**(viii) Claims Appendix (page 45)**  
**(ix) Evidence Appendix (page 50)**  
**(x) Related Proceedings Appendix (page 51)**

**(i) Real Party In Interest**

The real party in interest in this appeal is Automotive Systems Laboratory, Inc., a Delaware corporation, the owner of the subject application by assignment.

**(ii) Related Appeals And Interferences**

There are presently no other appeals and/or interferences known to appellant, appellant's legal representative, or assignee which will directly affect or be directly affected by the Board's decision in the pending appeal.



**(iii) Status Of Claims**

Claims 21, 23, 25, 27, 29, 31, 34-47 are pending and stand finally rejected in an Office Action mailed on September 25, 2006 (Paper # 20060918). The rejections of claims 21, 23, 25, 27, 29, 31, and 34-47 are appealed herein.

**(iv) Status Of Amendments**

In the final rejection (Paper No. 20060918), mailed September 25, 2006, the Examiner indicated that the amendment to the claims set forth in Applicants' amendment, filed June 26, 2006, was entered.

**(v) Summary of Claimed Subject Matter**

**INDEPENDENT CLAIM 21**

In one aspect of the present invention, a vehicle occupant protection system constructed as known in the art (page 1, lines 9-11; page 3, lines 6-11; page 4, lines 5-15 and lines 28-30; page 5, lines 1-15; page 8, lines 22-30; page 9, lines 1-5; page 12, lines 17-20; and page 13, lines 1-6), is provided including an inflatable air bag (page 13, line 3), a gas generator for inflating the air bag (page 8, lines 18-27; pages 10-12, in Examples 1-4; and page 13, lines 1-7); a nitrogen-containing gas generant composition within the gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof (page 1, lines 29-31; page 4, lines 1-15; page 5, lines 11-21; page 6, lines 17-30 – page 7, lines 1-2), and, a selective non-catalytic reducing (SNCR) compound placed within the gas generator in heterogeneous relation to the gas generant composition, wherein the SNCR compound is selected from ammonium salts and amine-containing compounds (page 5, lines 22-30; page 6, lines 1-16; pages 10-12, in Examples 1-4; page 13, lines 9-11), wherein at least one mol of the SNCR compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of the gas generant composition (page 7, line 3-page 8, line 14; page 9, lines 6-16; page 11, line 14-page 12, line 3).

**INDEPENDENT CLAIM 23**

In one aspect of the present invention, a vehicle occupant protection system constructed as known in the art (page 1, lines 9-11; page 3, lines 6-11; page 4, lines 5-15 and lines 28-30; page 5, lines 1-15; page 8, lines 22-30; page 9, lines 1-5; page 12, lines 17-20; and page 13, lines 1-6), is provided including an inflatable air bag (page 13, line 3), a gas generator for inflating the air bag (page 8, lines 18-27; pages 10-12, in Examples 1-4; and page 13, lines 1-7); a nitrogen-containing nonazide gas generant composition within the gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof (page 1, lines 29-31; page 4, lines 1-15; page 5, lines 11-21; page 6, lines 17-30 – page 7, lines 1-2), and, a selective non-catalytic reducing (SNCR) compound placed within the gas generator in heterogeneous relation to the gas generant composition, wherein the SNCR compound is selected from ammonium salts and amine-containing compounds (page 5, lines 22-30; page 6, lines 1-16; pages 10-12, in Examples 1-4; page 13, lines 9-11), wherein at least one mol of the SNCR compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of the gas generant composition (page 7, line 3-page 8, line 14; page 9, lines 6-16; page 11, line 14-page 12, line 3).

**INDEPENDENT CLAIM 25**

In one aspect of the present invention, a vehicle occupant protection system constructed as known in the art (page 1, lines 9-11; page 3, lines 6-11; page 4, lines 5-15 and lines 28-30; page 5, lines 1-15; page 8, lines 22-30; page 9, lines 1-5; page 12, lines 17-20; and page 13, lines 1-6), is provided including an inflatable air bag

(page 13, line 3), a gas generator for inflating the air bag (page 8, lines 18-27; pages 10-12, in Examples 1-4; and page 13, lines 1-7); a gas generant composition within the gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof (page 1, lines 29-31; page 4, lines 1-15; page 5, lines 11-21; page 6, lines 17-30 – page 7, lines 1-2), and, a selective non-catalytic reducing (SNCR) compound proximate to, separate from, and interspersed about the gas generant composition within the gas generator, wherein the SNCR compound is selected from ammonium salts and amine-containing compounds (page 5, lines 22-30; page 6, lines 1-16; pages 10-12, in Examples 1-4; page 13, lines 9-11), wherein at least one mol of the SNCR compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of the gas generant composition (page 7, line 3-page 8, line 14; page 9, lines 6-16; page 11, line 14-page 12, line 3).

#### INDEPENDENT CLAIM 27

In one aspect of the present invention, a vehicle occupant protection system constructed as known in the art (page 1, lines 9-11; page 3, lines 6-11; page 4, lines 5-15 and lines 28-30; page 5, lines 1-15; page 8, lines 22-30; page 9, lines 1-5; page 12, lines 17-20; and page 13, lines 1-6), is provided including an inflatable air bag (page 13, line 3), a gas generator for inflating the air bag (page 8, lines 18-27; pages 10-12, in Examples 1-4; and page 13, lines 1-7); a gas generant composition within the gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof (page 1, lines 29-31; page 4, lines 1-15; page 5, lines 11-21; page 6, lines 17-30 – page 7, lines 1-2), and, a selective non-catalytic reducing (SNCR) compound proximate to, separate from, and interspersed about the gas generant composition within the gas generator, wherein the SNCR compound is selected from ammonium salts, amides, imides, and amine-containing compounds (page 5, lines 22-30; page 6, lines 1-16; pages 10-12, in Examples 1-4; page 13, lines 9-11), wherein at least one mol of the SNCR compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of the gas generant composition (page 7, line 3-page 8, line 14; page 9, lines 6-16; page 11, line 14-page 12, line 3).

#### INDEPENDENT CLAIM 29

In one aspect of the present invention, a vehicle occupant protection system constructed as known in the art (page 1, lines 9-11; page 3, lines 6-11; page 4, lines 5-15 and lines 28-30; page 5, lines 1-15; page 8, lines 22-30; page 9, lines 1-5; page 12, lines 17-20; and page 13, lines 1-6), is provided including an inflatable air bag (page 13, line 3), a gas generator for inflating the air bag (page 8, lines 18-27; pages 10-12, in Examples 1-4; and page 13, lines 1-7); a nonazide gas generant composition within the gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof (page 1, lines 29-31; page 4, lines 1-15; page 5, lines 11-21; page 6, lines 17-30 – page 7, lines 1-2), and, a selective non-catalytic reducing (SNCR) compound proximate to, separate from, and interspersed about the gas generant composition within the gas generator, wherein the SNCR compound is selected from ammonium salts, amides, imides, and amine-containing compounds (page 5, lines 22-30; page 6, lines 1-16; pages 10-12, in Examples 1-4; page 13, lines 9-11), wherein at least one mol of the SNCR compound is added per mol of nitrogen oxide or nitrogen dioxide

produced upon combustion of the gas generant composition (page 7, line 3-page 8, line 14; page 9, lines 6-16; page 11, line 14-page 12, line 3).

#### INDEPENDENT CLAIM 31

In one aspect of the present invention, a vehicle occupant protection system constructed as known in the art (page 1, lines 9-11; page 3, lines 6-11; page 4, lines 5-15 and lines 28-30; page 5, lines 1-15; page 8, lines 22-30; page 9, lines 1-5; page 12, lines 17-20; and page 13, lines 1-6), is provided including an inflatable air bag (page 13, line 3), a gas generator for inflating the air bag (page 8, lines 18-27; pages 10-12, in Examples 1-4; and page 13, lines 1-7 ); a nitrogen-containing gas generant composition located within the gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof (page 1, lines 29-31; page 4, lines 1-15; page 5, lines 11-21; page 6, lines 17-30 – page 7, lines 1-2 ), and, a selective non-catalytic reducing (SNCR) compound proximate to and interspersed about the gas generant composition, wherein the SNCR compound is selected from ammonium salts (page 5, lines 22-30; page 6, lines 1-16; pages 10-12, in Examples 1-4; page 13, lines 9-11), wherein at least one mol of the SNCR compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of the gas generant composition (page 7, line 3-page 8, line 14; page 9, lines 6-16; page 11, line 14-page 12, line 3).

#### INDEPENDENT CLAIM 34

In one aspect of the present invention, a vehicle occupant protection system constructed as known in the art (page 1, lines 9-11; page 3, lines 6-11; page 4, lines 5-15 and lines 28-30; page 5, lines 1-15; page 8, lines 22-30; page 9, lines 1-5; page 12, lines 17-20; and page 13, lines 1-6), is provided including an inflatable air bag (page 13, line 3), a gas generator for inflating the air bag (page 8, lines 18-27; pages 10-12, in Examples 1-4; and page 13, lines 1-7 ); a nitrogen-containing gas generant composition within the gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof (page 1, lines 29-31; page 4, lines 1-15; page 5, lines 11-21; page 6, lines 17-30 – page 7, lines 1-2 ), and, a selective non-catalytic reducing (SNCR) compound in heterogeneous relation to the gas generant composition, wherein the SNCR compound is selected from ammonium salts, amides, imides, and amine-containing compounds (page 5, lines 22-30; page 6, lines 1-16; pages 10-12, in Examples 1-4; page 13, lines 9-11), wherein at least one mol of the SNCR compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of the gas generant composition (page 7, line 3-page 8, line 14; page 9, lines 6-16; page 11, line 14-page 12, line 3).

**(vi) Grounds Of Rejection To Be Reviewed On Appeal**

Whether claims 21, 23, 25, 27, 29, 31, and 34-47 are anticipated under 35 U.S.C. § 103(a) as being unpatentable over Poole, U.S. Patent No. 5,139,588 in view of Pacanowsky et al., U.S. Patent No. 3,993,514.

**(vii) Argument**

**A. Rejections Under 35 U.S.C. § 103(a) as being unpatentable over Poole, U.S. Patent No. 5,139,588 in view of Pacanowsky et al., U.S. Patent No. 3,993,514.**

In pages 2-5 of the final Office Action, the Examiner states:

"Claims 21, 23, 25, 27, 29, 31, and 34-47 are rejected under 35 103(a) as being unpatentable over Poole (US 5,139,588...) in view of Pacanowsky et al. (US 3,993,514).

As to claims 21, 23, 25, 27, 29, 31, 34, and 40-47, Poole et al. (588) discloses a vehicle occupant restraint system (abstract) comprising an inflatable air bag (inherent in abstract); a gas generator (col. 6 lines 39-65) for inflating the air bag; a nitrogen-containing, non azide gas generant ("tetrazole" of col. 5 lines 3-4) composition within the gas generator that forms nitrogen oxide or dioxide upon combustion (from col. 8 lines 39-50). Not disclosed is a selective noncatalytic reducing compound, ammonium salt, is placed with the gas generant composition, wherein at least one mol of ammonium sulfate is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of the gas generant composition. Pacanowsky et al, however, disclose the use of ammonium sulfate with a non-azide gas generant (col. 3 lines 1-8). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Poole et al. ('588) by adding a non-catalytic reducing compound of ammonium sulfate as disclosed by Pacanowsky et al. so as to change to reduce the flame temperature (Pacanowsky et al. at col. 3 lines 1-8) and to have at least one mol of ammonium sulfate is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of the gas generant composition depending upon the flame temperature desired.

As to claim 35, Poole et al. ('588) and Pacanowsky et al. further disclose compression molding (for example, col. 9, example 1 of Poole et al. ('588)) and NO gas produced upon combustion (col. 8, lines 39-47 of Poole et al. ('588)). Not disclosed are extrusion into a desirable shape, at least one mole of elemental N per mole of NOx, and the reducing compound discretely interspersed about the gas generant composition. Pacanowsky et al., however, discloses the reducing compound discretely interspersed about the gas generant composition (col. 4 lines 53-68). It would have been obvious to one of ordinary skill in the art at the time of the invention to further modify the system of Poole et al. ('588) as modified by Pacanowsky et al. by interspersing as disclosed by Pacanowsky et al. so as to optimize reaction rates and to extrude the composition into a desired shape so as to make the system more useable and to have at least one mole of elemental N per mole of NOx depending upon needs of the system.

As to claim 36, Poole et al. ('588) and Pacanowsky et al. further disclose tetrazole (col. 6 lines 39-46 of Poole et al. ('588)), alkaline earth metal lanthanide (col. 6 lines 47-51 of Poole et al. ('588)), a

low temperature slag of clay (col. 6 lines 58-65 of Poole et al. ('588)). Not disclosed are extrusion into a desirable shape, at least one mole of elemental N per mole of NO<sub>x</sub>, and the reducing compound discretely interspersed about the gas generant composition. Pacanowsky et al., however, discloses the reducing compound discretely interspersed about the gas generant composition (col. 4 lines 53-68). It would have been obvious to one of ordinary skill in the art at the time of the invention to further modify the system of Poole et al. ('588) as modified by Pacanowsky et al. by interspersing as disclosed by Pacanowsky et al. so as to optimize reaction rates and to extrude the composition into a desired shape so as to make the system more useable and to have at least one mole of elemental N per mole of NO<sub>x</sub> depending upon needs of the system.

As to claims 37-39, Poole et al. ('588) and Pacanowsky et al. further disclose nitrogen oxide and nitrogen dioxide (from "oxides of nitrogen (NO<sub>x</sub>)" of col. 2 lines 6-12 of Poole et al. ('588)). Not disclosed is the reducing compound proximate to and discretely interspersed about the gas generant composition. Pacanowsky et al., however, discloses the reducing compound discretely interspersed about the gas generant composition (col. 4 lines 53-68). It would have been obvious to one of ordinary skill in the art at the time of the invention to further modify the system of Poole et al. ('588) as modified by Pacanowsky et al. by interspersing as disclosed by Pacanowsky et al. so as to optimize reaction rates and to have the reducing compound proximate to the gas generant composition to add more reducing compound so as to further cool the system.

### ***Response to Arguments***

Applicant's arguments filed 26 June 2006 have been fully considered but they are not persuasive. Applicants' arguments are: (1) neither Poole et al. ('588) nor Pacanowsky et al. disclose a discrete selectively non-catalytic reducing (SNCR) agent, ammonium sulfate, and a separate gas generant composition; (Remarks page 1, 1<sup>st</sup> para.); and, (2) Pacanowsky et al. does not describe the use of ammonium sulfate as a discrete nitrogen compound but instead within the composition which would attenuate the affects of acceleration (Remarks page 10, 1<sup>st</sup> para.) As to arguments (1) and (2), Examiner considers Pacanowsky et al. to disclose ammonium sulfate with a separate gas generation composition (see for example, col. 4 lines 63-68 of Pacanowsky et al.). The ammonium sulfate in either the Poole et al. ('588) composition or the Pacanowsky et al. composition would function, in part, as a selectively non-catalytic reducing (SNCR) agent because it is well decided that if a composition is physically the same, it must have the same properties (see MPEP 2112.01(11)). Pacanowsky et al. discloses that ammonium sulfate functions to both reduce the effect of acceleration on burn characteristics of a composition and to reduce flame temperature of the composition (Pacanowsky et al. at col. 3 lines 1-8). Examiner considers ammonium sulfate to have a third effect - acting as a discrete SNCR agent."



In the Advisory Action of January 17, 2007, the examiner states:

“The request for reconsideration has been considered but does NOT place the application in condition for allowance because: Pacanowsky et al. discloses the use of ammonium sulfate to decrease the effect of compression and to act as a coolant. Ammonium sulfate would also act as an SNCR agent when in a composition. Further, Pacanowsky et al. discloses that the mixing time may vary (col. 5 lines 1-5). When mixing time is short the composition would not be uniformly mixed, hence, the ammonium sulfate would be heterogeneous in relation to the other constituents in the composition.”

35 U.S.C. 103(a) states:

**“(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.”**

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

#### **CLAIM 21**

Claim 21 recites:

- “21. A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a nitrogen-containing gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and
  - a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds,
- wherein at least one mol of the selective non-catalytic reducing compound is added per one mol

of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.”

**A prima facie case of obviousness of claim 21 over Poole, U.S. Patent No. 5,139,588 in view of Pacanowsky et al., U.S. Patent No. 3,993,514 has not been established because the references, when combined, do not teach or suggest all the limitations of claim 21. Furthermore, neither Poole nor Pacanowsky provide the requisite suggestion within the references to combine the two references thereby resulting in the present invention.**

The examiner indicates that Poole et al. ('588) discloses a vehicle occupant restraint system; an inflatable air bag; a gas generator for inflating the air bag; a nitrogen-containing, non azide gas generant composition within the gas generator that forms nitrogen oxide or dioxide upon combustion. The examiner acknowledges that '588 *does not disclose* a selective non-catalytic reducing (SNCR) compound, ammonium salt, placed with the gas generant composition, wherein at least one mol of ammonium sulfate is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of the gas generant composition. The applicants note that a gas generator is not explicitly discussed within '588.

Even if support for a teaching of a gas generator is arguably present, the applicants agree that Poole '588 neither teaches, nor suggests, nor motivates one of ordinary skill in the art *to provide an SNCR compound within a gas generator in heterogeneous relation to a gas generant composition within the gas generator*, wherein the selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds.

In fact, Poole '588 specifically describes another method of reducing the toxic gases NO<sub>x</sub> and CO:

“ *The invention importantly provides means of reducing the amount of the toxic gases NO<sub>x</sub> and CO in gas generant combustion products. This is accomplished by using an alkali metal salt mixed into the propellant.* The primary effect of the salt is to reduce the amount of NO<sub>x</sub> but this allows formulation of the gas generant to provide an excess of oxygen, in the combustion products, which reduces the amount of carbon monoxides as well as the NO<sub>x</sub>.

The invention contemplates application of these means to any gas generant which produces NO<sub>x</sub> and carbon monoxide.

The type of alkali metal compound used is important. While all alkali metals are likely to be effective in controlling NO<sub>x</sub>, potassium is the most preferred alkali metal because of its availability, low cost and effectiveness...” See Poole '588, Column 8, lines 39-55

As evident from the quoted text of '588, Poole clearly understood the problem of NO<sub>x</sub> and carbon monoxide in the gaseous effluent, and as such, solved the problem by *mixing an alkali metal salt* into the gas generant composition. There is no suggestion or motivation to approach the problem of NO<sub>x</sub> and carbon monoxide reduction in any other way, other than by mixing an alkali metal salt within the gas generant composition as explicitly taught as inventive by Poole.

Pacanowsky et al. '514 does not cure the deficiencies of Poole '588. The examiner indicates that it would have been obvious to one of ordinary skill in the art to modify the system of Poole et al. ('588) by adding a non-catalytic reducing compound of ammonium sulfate as disclosed by Pacanowsky et al. so as to change the flame temperature. The examiner fails to appreciate that Pacanowsky teaches *mixtures* of ammonium sulfate within the composition. Note '514 at column 2, lines 63-68:

“ *The present invention is predicated on the discovery* that the burning rate of gas generating compositions can be rendered substantially insensitive to the effects of compressive accelerative forces *by incorporating in the composition* a suitable amount of ammonium sulfate.” See Pacanowsky '514, column 2, lines 63-68.

It can therefore be concluded that Pacanowsky required a mixture, not a *heterogeneous* relationship, between ammonium sulfate and the gas generant composition, in accordance with claim 21. The ammonium sulfate *must* be incorporated in the composition, not loosely distributed about the gas generant composition.

The examiner urges that Pacanowsky '514 in fact “discloses the reducing compound discretely interspersed about the gas generant composition (citing col. 4 lines 53-68), and therefore, “it would be obvious to one of ordinary skill in the art at the time of the invention to further modify the system of Poole et al. ('588) as modified by Pacanowsky by interspersing as disclosed by Pacanowsky...”.

This is simply not accurate as revealed by a careful reading of the portion of the text cited by the examiner in support of his position:

- “ In general, the present compositions comprise:
1. From 40% to 70% by weight of finely divided inorganic perchlorate oxidizer, preferably ammonium perchlorate,
  2. From 10% to 35% of an elastomeric combustible fuel binder,
  3. From 5% to 35% of an acceleration force desensitizer which is ammonium sulfate, and
  4. From 0 to 10% by weight of the special purpose additives referred to above.

*In preparing the present compositions the perchlorate oxidizer in finely divided form and the liquid fuel binder and curing agent therefore, and the ammonium sulfate desensitizer also in finely divided form are placed in a mixer together with the special purpose additives if required and thoroughly mixed.*” See Pacanowsky '514, column 4, lines 53-68.

As described by Pacanowsky, and in contradiction to what the examiner urges, ammonium sulfate is therefore thoroughly mixed within the gas generant composition, rather than in *heterogeneous* relation to the gas generant composition as required in claim 21.

In the advisory action dated January 17, 2007, the examiner in response to the applicants' request for reconsideration filed on December 26, 2007, indicates that the mixing time may vary and cites column 5, lines 10-5 in support of the argument that if the mixing time is short, then there would not be uniformity in the

mixture, and therefore ammonium sulfate would be heterogeneous in relation to the other constituents in the composition. Again, Pacanowsky undercuts the examiner's conclusions in the very text cited by the examiner:

“ The mixing time required to achieve the *desired degree of uniformity* varies according to the batch size and properties of the ingredients used such as viscosity of the fuel binder prepolymer, the nature of the curing agent, and particle size of the oxidizer and desensitizer. Ordinarily at least 30 minutes is required to achieve the desired uniformity. The mixed composition is introduced into a suitable casing...” See Pacanowsky ‘514, column 5, lines 1-8.

It should be emphasized that the “desired degree of uniformity” does not change, as suggested by the examiner. Rather, the “mixing time” varies according to the batch size and properties of the ingredients used such as viscosity and particle size. This makes sense. The composition cannot be “thoroughly mixed” and yet “not be uniformly mixed” as postulated by the examiner. Stated another way, there cannot be a “desired degree of uniformity” without uniform mixing. Again, note that “ordinarily at least 30 minutes is required to achieve the desired uniformity”. Accordingly, Pacanowsky et al. is concerned with thoroughly mixing the composition, including ammonium sulfate, thereby ensuring the desired uniformity regardless of the properties of the constituents of the composition.

When viewed in proper context, Pacanowsky does not teach heterogeneous compositions while simultaneously teaching uniform compositions. The two notions are at opposite extremes and cannot exist together. Pacanowsky in fact teaches away from heterogeneous relationship between ammonium sulfate and the gas generant composition. When a reference teaches away, it cannot simultaneously suggest or teach the present invention. MPEP 2145 D. Prior art must be considered in its entirety, including disclosures that teach away from the claims. A prior art reference that teaches away from the claimed invention is a significant factor to be considered in determining obviousness; the nature of the teaching is highly relevant and must be weighed in substance. *In re Gurley*, 27 F.3d 551, 554, 31 USPQ2d 1130, 1132 (Fed. Cir. 1994)

Because neither Poole nor Pacanowsky describe ammonium sulfate in heterogeneous relationship, that element of the claims is simply not present in either reference. When the references when taken alone or together fail to teach all of the elements of the claim, a prima facie case of obviousness is simply not supported.

For the reasons set forth above, neither Poole ‘588 nor Pacanowsky et al. ‘514 when taken alone or in combination teach, show, or suggest all of the elements recited in claim 21 of the present application. In addition, there is no suggestion in either reference to combine the teachings of each reference to thereby result in the invention as claimed, *even if all of the limitations were described within the references*. In the absence of a suggestion within the references, the examiner's conclusion of obviousness appears to be based on improper hindsight reasoning. As such, a prima facie case of obviousness of claim 21 over Poole in view of Pacanowsky has not been established, and the rejection of claim 21 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 21 allowed.

**CLAIM 23**

Claim 23 recites:

“23. A vehicle occupant restraint system comprising:  
an inflatable air bag;  
a gas generator for inflating said air bag;  
a nitrogen-containing nonazide gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and  
a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds,  
wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.”

**A prima facie case of obviousness of claim 23 over Poole, U.S. Patent No. 5,139,588 in view of Pacanowsky et al., U.S. Patent No. 3,993,514 has not been established because the references, when combined, do not teach or suggest all the limitations of claim 23. Furthermore, neither Poole nor Pacanowsky provide the requisite suggestion within the references to combine the two references thereby resulting in the present invention.**

The examiner indicates that Poole et al. ('588) discloses a vehicle occupant restraint system; an inflatable air bag; a gas generator for inflating the air bag; a nitrogen-containing non azide gas generant composition within the gas generator that forms nitrogen oxide or dioxide upon combustion. The examiner acknowledges that '588 **does not disclose** a selective non-catalytic reducing (SNCR) compound, ammonium salt, placed with the gas generant composition, wherein at least one mol of ammonium sulfate is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of the gas generant composition. The applicants note that a gas generator is not explicitly discussed within '588.

Even if support for a teaching of a gas generator is arguably present, the applicants agree that Poole '588 neither teaches, nor suggests, nor motivates one of ordinary skill in the art **to provide an SNCR compound within a gas generator in heterogeneous relation to a gas generant composition within the gas generator,** wherein the selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds.

In fact, Poole '588 specifically describes another method of reducing the toxic gases NOx and CO:

“ *The invention importantly provides means of reducing the amount of the toxic gases NOx and CO in gas generant combustion products. This is accomplished by using an alkali metal salt mixed into the propellant.* The primary effect of the salt is to reduce the amount of NOx but this allows formulation of the gas generant to provide an excess of oxygen, in the combustion products, which reduces the amount of carbon monoxides as well as the NOx.

The invention contemplates application of these means to any gas generant which produces NOx and carbon monoxide.

The type of alkali metal compound used is important. While all alkali metals are likely to be effective in controlling NOx, potassium is the most preferred alkali metal because of its availability, low cost and effectiveness...” See Poole ‘588, Column 8, lines 39-55

As evident from the quoted text of ‘588, Poole clearly understood the problem of NOx and carbon monoxide in the gaseous effluent, and as such, solved the problem by *mixing an alkali metal salt* into the gas generant composition. There is no suggestion or motivation to approach the problem of NOx and carbon monoxide reduction in any other way, other than by mixing an alkali metal salt within the gas generant composition as explicitly taught as inventive by Poole.

Pacanowsky et al. ‘514 does not cure the deficiencies of Poole ‘588. The examiner indicates that it would have been obvious to one of ordinary skill in the art to modify the system of Poole et al. (‘588) by adding a non-catalytic reducing compound of ammonium sulfate as disclosed by Pacanowsky et al. so as to change the flame temperature. The examiner fails to appreciate that Pacanowsky teaches *mixtures* of ammonium sulfate within the composition. Note ‘514 at column 2, lines 63-68:

“ *The present invention is predicated on the discovery* that the burning rate of gas generating compositions can be rendered substantially insensitive to the effects of compressive accelerative forces *by incorporating in the composition* a suitable amount of ammonium sulfate.” See Pacanowsky ‘514, column 2, lines 63-68.

It can therefore be concluded that Pacanowsky required a mixture, not a *heterogeneous* relationship, between ammonium sulfate and the gas generant composition, in accordance with claim 23. The ammonium sulfate *must* be incorporated in the composition, not loosely distributed about the gas generant composition.

The examiner urges that Pacanowsky ‘514 in fact “discloses the reducing compound discretely interspersed about the gas generant composition (citing col. 4 lines 53-68), and therefore, “it would be obvious to one of ordinary skill in the art at the time of the invention to further modify the system of Poole et al. (‘588) as modified by Pacanowsky by interspersing as disclosed by Pacanowsky...”.

This is simply not accurate as revealed by a careful reading of the portion of the text cited by the examiner in support of his position:

“ In general, the present compositions comprise:  
1. From 40% to 70% by weight of finely divided inorganic perchlorate oxidizer, preferably ammonium perchlorate,

2. From 10% to 35% of an elastomeric combustible fuel binder,
3. From 5% to 35% of an acceleration force desensitizer which is ammonium sulfate, and
4. From 0 to 10% by weight of the special purpose additives referred to above.

*In preparing the present compositions the perchlorate oxidizer in finely divided form and the liquid fuel binder and curing agent therefore, and the ammonium sulfate desensitizer also in finely divided form are placed in a mixer together with the special purpose additives if required and thoroughly mixed.*” See Pacanowsky ‘514, column 4, lines 53-68.

As described by Pacanowsky, and in contradiction to what the examiner urges, ammonium sulfate is therefore thoroughly mixed within the gas generant composition, rather than in *heterogeneous* relation to the gas generant composition as required in claim 23.

In the advisory action dated January 17, 2007, the examiner in response to the applicants’ request for reconsideration filed on December 26, 2007, indicates that the mixing time may vary and cites column 5, lines 10-5 in support of the argument that if the mixing time is short, then there would not be uniformity in the mixture, and therefore ammonium sulfate would be heterogeneous in relation to the other constituents in the composition. Again, Pacanowsky undercuts the examiner’s conclusions in the very text cited by the examiner:

“ The mixing time required to achieve the *desired degree of uniformity* varies according to the batch size and properties of the ingredients used such as viscosity of the fuel binder prepolymer, the nature of the curing agent, and particle size of the oxidizer and desensitizer. Ordinarily at least 30 minutes is required to achieve the desired uniformity. The mixed composition is introduced into a suitable casing...” See Pacanowsky ‘514, column 5, lines 1-8.

It should be emphasized that the “desired degree of uniformity” does not change, as suggested by the examiner. Rather, the “mixing time” varies according to the batch size and properties of the ingredients used such as viscosity and particle size. This makes sense. The composition cannot be “thoroughly mixed” and yet “not be uniformly mixed” as postulated by the examiner. Stated another way, there cannot be a “desired degree of uniformity” without uniform mixing. Again, note that “ordinarily at least 30 minutes is required to achieve the desired uniformity”. Accordingly, Pacanowsky et al. is concerned with thoroughly mixing the composition, including ammonium sulfate, thereby ensuring the desired uniformity regardless of the properties of the constituents of the composition.

When viewed in proper context, Pacanowsky does not teach heterogeneous compositions while simultaneously teaching uniform compositions. The two notions are at opposite extremes and cannot exist together. Pacanowsky in fact teaches away from heterogeneous relationship between ammonium sulfate and the gas generant composition. When a reference teaches away, it cannot simultaneously suggest or teach the present invention. MPEP 2145 D. Prior art must be considered in its entirety, including disclosures that teach away from the claims. A prior art reference that teaches away from the claimed invention is a significant factor to be

considered in determining obviousness; the nature of the teaching is highly relevant and must be weighed in substance. *In re Gurley*, 27 F.3d 551, 554, 31 USPQ2d 1130, 1132 (Fed. Cir. 1994)

Because neither Poole nor Pacanowsky describe ammonium sulfate in heterogeneous relationship, that element of the claims is simply not present in either reference. When the references when taken alone or together fail to teach all of the elements of the claim, a prima facie case of obviousness is simply not supported.

For the reasons set forth above, neither Poole '588 nor Pacanowsky et al. '514 when taken alone or in combination teach, show, or suggest all of the elements recited in claim 23 of the present application. In addition, there is no suggestion in either reference to combine the teachings of each reference to thereby result in the invention as claimed, *even if all of the limitations were described within the references*. In the absence of a suggestion within the references, the examiner's conclusion of obviousness appears to be based on improper hindsight reasoning. As such, a prima facie case of obviousness of claim 23 over Poole in view of Pacanowsky has not been established, and the rejection of claim 23 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 23 allowed.

#### CLAIM 25

Claim 25 recites:

"25. (previously presented) A vehicle occupant restraint system comprising:

- an inflatable air bag;
- a gas generator for inflating said air bag;
- a gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and
- a selective non-catalytic reducing compound proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds,

wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition."

**A prima facie case of obviousness of claim 25 over Poole, U.S. Patent No. 5,139,588 in view of Pacanowsky et al., U.S. Patent No. 3,993,514 has not been established because the references, when combined, do not teach or suggest all the limitations of claim 25. Furthermore, neither Poole nor Pacanowsky provide the requisite suggestion within the references to combine the two references thereby resulting in the present invention.**



The examiner indicates that Poole et al. ('588) discloses a vehicle occupant restraint system; an inflatable air bag; a gas generator for inflating the air bag; a gas generant composition within the gas generator that forms nitrogen oxide or dioxide upon combustion. The examiner acknowledges that '588 *does not disclose* a selective non-catalytic reducing (SNCR) compound, ammonium salt, placed with the gas generant composition, wherein at least one mol of ammonium sulfate is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of the gas generant composition. The applicants note that a gas generator is not explicitly discussed within '588.

Even if support for a teaching of a gas generator is arguably present, the applicants agree that Poole '588 neither teaches, nor suggests, nor motivates one of ordinary skill in the art *to provide an SNCR compound within a gas generator in heterogeneous relation to a gas generant composition within the gas generator*, wherein the selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds.

In fact, Poole '588 specifically describes another method of reducing the toxic gases NOx and CO:

“ *The invention importantly provides means of reducing the amount of the toxic gases NOx and CO in gas generant combustion products. This is accomplished by using an alkali metal salt mixed into the propellant.* The primary effect of the salt is to reduce the amount of NOx but this allows formulation of the gas generant to provide an excess of oxygen, in the combustion products, which reduces the amount of carbon monoxides as well as the NOx.

The invention contemplates application of these means to any gas generant which produces NOx and carbon monoxide.

The type of alkali metal compound used is important. While all alkali metals are likely to be effective in controlling NOx, potassium is the most preferred alkali metal because of its availability, low cost and effectiveness...” See Poole '588, Column 8, lines 39-55

As evident from the quoted text of '588, Poole clearly understood the problem of NOx and carbon monoxide in the gaseous effluent, and as such, solved the problem by *mixing an alkali metal salt* into the gas generant composition. There is no suggestion or motivation to approach the problem of NOx and carbon monoxide reduction in any other way, other than by mixing an alkali metal salt within the gas generant composition as explicitly taught as inventive by Poole.

Pacanowsky et al. '514 does not cure the deficiencies of Poole '588. The examiner indicates that it would have been obvious to one of ordinary skill in the art to modify the system of Poole et al. ('588) by adding a non-catalytic reducing compound of ammonium sulfate as disclosed by Pacanowsky et al. so as to change the flame temperature. The examiner fails to appreciate that Pacanowsky teaches *mixtures* of ammonium sulfate within the composition. Note '514 at column 2, lines 63-68:

“ *The present invention is predicated on the discovery* that the burning rate of gas generating compositions can be rendered substantially insensitive to the effects of compressive accelerative forces *by incorporating in the composition* a suitable amount of ammonium sulfate.” See Pacanowsky '514, column 2, lines 63-68.

It can therefore be concluded that Pacanowsky required a mixture, not a *proximate and separate* relationship, between ammonium sulfate and the gas generant composition, in accordance with claim 25. The ammonium sulfate *must* be incorporated in the composition, not loosely distributed about the gas generant composition.

The examiner urges that Pacanowsky '514 in fact "discloses the reducing compound discretely interspersed about the gas generant composition (citing col. 4 lines 53-68), and therefore, "it would be obvious to one of ordinary skill in the art at the time of the invention to further modify the system of Poole et al. ('588) as modified by Pacanowsky by interspersing as disclosed by Pacanowsky..."

This is simply not accurate as revealed by a careful reading of the portion of the text cited by the examiner in support of his position:

- " In general, the present compositions comprise:
1. From 40% to 70% by weight of finely divided inorganic perchlorate oxidizer, preferably ammonium perchlorate,
  2. From 10% to 35% of an elastomeric combustible fuel binder,
  3. From 5% to 35% of an acceleration force desensitizer which is ammonium sulfate, and
  4. From 0 to 10% by weight of the special purpose additives referred to above.
- In preparing the present compositions the perchlorate oxidizer in finely divided form and the liquid fuel binder and curing agent therefore, and the ammonium sulfate desensitizer also in finely divided form are placed in a mixer together with the special purpose additives if required and thoroughly mixed.*" See Pacanowsky '514, column 4, lines 53-68.

As described by Pacanowsky, and in contradiction to what the examiner urges, ammonium sulfate is therefore thoroughly mixed within the gas generant composition, rather than in *proximate and separate* relation to the gas generant composition as required in claim 25.

In the advisory action dated January 17, 2007, the examiner in response to the applicants' request for reconsideration filed on December 26, 2007, indicates that the mixing time may vary and cites column 5, lines 10-5 in support of the argument that if the mixing time is short, then there would not be uniformity in the mixture, and therefore ammonium sulfate would be heterogeneous in relation to the other constituents in the composition. Again, Pacanowsky undercuts the examiner's conclusions in the very text cited by the examiner:

" The mixing time required to achieve the *desired degree of uniformity varies* according to the batch size and properties of the ingredients used such as viscosity of the fuel binder prepolymer, the nature of the curing agent, and particle size of the oxidizer and desensitizer. Ordinarily at least 30 minutes is required to achieve the desired uniformity. The mixed composition is introduced into a suitable casing..." See Pacanowsky '514, column 5, lines 1-8.

It should be emphasized that the “**desired degree of uniformity**” does not change, as suggested by the examiner. Rather, the “**mixing time**” varies according to the batch size and properties of the ingredients used such as viscosity and particle size. This makes sense. The composition cannot be “**thoroughly mixed**” and yet “**not be uniformly mixed**” as postulated by the examiner. Stated another way, there cannot be a “desired degree of uniformity” without uniform mixing. Again, note that “ordinarily at least 30 minutes is required to achieve the desired uniformity”. Accordingly, Pacanowsky et al. is concerned with thoroughly mixing the composition, including ammonium sulfate, thereby ensuring the desired uniformity regardless of the properties of the constituents of the composition.

When viewed in proper context, Pacanowsky does not teach heterogeneous compositions while simultaneously teaching uniform compositions. The two notions are at opposite extremes and cannot exist together. Pacanowsky in fact teaches away from a *proximate and separate* relationship between ammonium sulfate and the gas generant composition. When a reference teaches away, it cannot simultaneously suggest or teach the present invention. MPEP 2145 D. Prior art must be considered in its entirety, including disclosures that teach away from the claims. A prior art reference that teaches away from the claimed invention is a significant factor to be considered in determining obviousness; the nature of the teaching is highly relevant and must be weighed in substance. *In re Gurley*, 27 F.3d 551, 554, 31 USPQ2d 1130, 1132 (Fed. Cir. 1994)

Because neither Poole nor Pacanowsky describe ammonium sulfate in *proximate and separate* relationship to the gas generant, that element of the claims is simply not present in either reference. When the references when taken alone or together fail to teach all of the elements of the claim, a prima facie case of obviousness is simply not supported.

For the reasons set forth above, neither Poole ‘588 nor Pacanowsky et al. ‘514 when taken alone or in combination teach, show, or suggest all of the elements recited in claim 25 of the present application. In addition, there is no suggestion in either reference to combine the teachings of each reference to thereby result in the invention as claimed, *even if all of the limitations were described within the references*. In the absence of a suggestion within the references, the examiner’s conclusion of obviousness appears to be based on improper hindsight reasoning. As such, a prima facie case of obviousness of claim 25 over Poole in view of Pacanowsky has not been established, and the rejection of claim 25 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 25 allowed.

#### **CLAIM 27**

Claim 27 recites:

“27. (previously presented) A vehicle occupant restraint system comprising:  
an inflatable air bag;

a gas generator for inflating said air bag;  
a gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and  
a selective non-catalytic reducing compound placed proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds,  
wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.”

**A prima facie case of obviousness of claim 27 over Poole, U.S. Patent No. 5,139,588 in view of Pacanowsky et al., U.S. Patent No. 3,993,514 has not been established because the references, when combined, do not teach or suggest all the limitations of claim 27. Furthermore, neither Poole nor Pacanowsky provide the requisite suggestion within the references to combine the two references thereby resulting in the present invention.**

The examiner indicates that Poole et al. ('588) discloses a vehicle occupant restraint system; an inflatable air bag; a gas generator for inflating the air bag; a gas generant composition within the gas generator that forms nitrogen oxide or dioxide upon combustion. The examiner acknowledges that '588 *does not disclose* a selective non-catalytic reducing (SNCR) compound, ammonium salt, placed with the gas generant composition, wherein at least one mol of ammonium sulfate is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of the gas generant composition. The applicants note that a gas generator is not explicitly discussed within '588.

Even if support for a teaching of a gas generator is arguably present, the applicants agree that Poole '588 neither teaches, nor suggests, nor motivates one of ordinary skill in the art *to provide an SNCR compound within a gas generator in heterogeneous relation to a gas generant composition within the gas generator*, wherein the selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds.

In fact, Poole '588 specifically describes another method of reducing the toxic gases NOx and CO:

***“ The invention importantly provides means of reducing the amount of the toxic gases NOx and CO in gas generant combustion products. This is accomplished by using an alkali metal salt mixed into the propellant. The primary effect of the salt is to reduce the amount of NOx but this allows formulation of the gas generant to provide an excess of oxygen, in the combustion products, which reduces the amount of carbon monoxides as well as the NOx.***

***The invention contemplates application of these means to any gas generant which produces NOx and carbon monoxide.***

***The type of alkali metal compound used is important. While all alkali metals are likely to be effective in controlling NOx, potassium is the most preferred alkali metal because of its availability, low cost and effectiveness...” See Poole '588, Column 8, lines 39-55***

As evident from the quoted text of '588, Poole clearly understood the problem of NOx and carbon monoxide in the gaseous effluent, and as such, solved the problem by *mixing an alkali metal salt* into the gas generant composition. There is no suggestion or motivation to approach the problem of NOx and carbon monoxide reduction in any other way, other than by mixing an alkali metal salt within the gas generant composition as explicitly taught as inventive by Poole.

Pacanowsky et al. '514 does not cure the deficiencies of Poole '588. The examiner indicates that it would have been obvious to one of ordinary skill in the art to modify the system of Poole et al. ('588) by adding a non-catalytic reducing compound of ammonium sulfate as disclosed by Pacanowsky et al. so as to change the flame temperature. The examiner fails to appreciate that Pacanowsky teaches *mixtures* of ammonium sulfate within the composition. Note '514 at column 2, lines 63-68:

“ *The present invention is predicated on the discovery* that the burning rate of gas generating compositions can be rendered substantially insensitive to the effects of compressive accelerative forces *by incorporating in the composition* a suitable amount of ammonium sulfate.” See Pacanowsky '514, column 2, lines 63-68.

It can therefore be concluded that Pacanowsky required a mixture, not a *proximate and separate* relationship, between ammonium sulfate and the gas generant composition, in accordance with claim 27. The ammonium sulfate *must* be incorporated in the composition, not loosely interspersed about the gas generant composition.

The examiner urges that Pacanowsky '514 in fact “discloses the reducing compound discretely interspersed about the gas generant composition (citing col. 4 lines 53-68), and therefore, “it would be obvious to one of ordinary skill in the art at the time of the invention to further modify the system of Poole et al. ('588) as modified by Pacanowsky by interspersing as disclosed by Pacanowsky...”.

This is simply not accurate as revealed by a careful reading of the portion of the text cited by the examiner in support of his position:

“ In general, the present compositions comprise:

1. From 40% to 70% by weight of finely divided inorganic perchlorate oxidizer, preferably ammonium perchlorate,
2. From 10% to 35% of an elastomeric combustible fuel binder,
3. From 5% to 35% of an acceleration force desensitizer which is ammonium sulfate, and
4. From 0 to 10% by weight of the special purpose additives referred to above.

*In preparing the present compositions the perchlorate oxidizer in finely divided form and the liquid fuel binder and curing agent therefore, and the ammonium sulfate desensitizer also in finely divided form are placed in a mixer together with the special purpose additives if required and thoroughly mixed.*” See Pacanowsky '514, column 4, lines 53-68.

As described by Pacanowsky, and in contradiction to what the examiner urges, ammonium sulfate is therefore thoroughly mixed within the gas generant composition, rather than in *proximate and separate* relation to the gas generant composition as required in claim 27.

In the advisory action dated January 17, 2007, the examiner in response to the applicants' request for reconsideration filed on December 26, 2007, indicates that the mixing time may vary and cites column 5, lines 10-5 in support of the argument that if the mixing time is short, then there would not be uniformity in the mixture, and therefore ammonium sulfate would be heterogeneous in relation to the other constituents in the composition. Again, Pacanowsky undercuts the examiner's conclusions in the very text cited by the examiner:

“ The mixing time required to achieve the *desired degree of uniformity* varies according to the batch size and properties of the ingredients used such as viscosity of the fuel binder prepolymer, the nature of the curing agent, and particle size of the oxidizer and desensitizer. Ordinarily at least 30 minutes is required to achieve the desired uniformity. The mixed composition is introduced into a suitable casing...” See Pacanowsky '514, column 5, lines 1-8.

It should be emphasized that the “desired degree of uniformity” does not change, as suggested by the examiner. Rather, the “mixing time” varies according to the batch size and properties of the ingredients used such as viscosity and particle size. This makes sense. The composition cannot be “thoroughly mixed” and yet “not be uniformly mixed” as postulated by the examiner. Stated another way, there cannot be a “desired degree of uniformity” without uniform mixing. Again, note that “ordinarily at least 30 minutes is required to achieve the desired uniformity”. Accordingly, Pacanowsky et al. is concerned with thoroughly mixing the composition, including ammonium sulfate, thereby ensuring the desired uniformity regardless of the properties of the constituents of the composition.

When viewed in proper context, Pacanowsky does not teach *proximate and separate* relation of SNCR compounds and gas generant compositions while simultaneously teaching uniform compositions. The two notions are at opposite extremes and cannot exist together. Pacanowsky in fact teaches away from heterogeneous relationship between ammonium sulfate and the gas generant composition. When a reference teaches away, it cannot simultaneously suggest or teach the present invention. MPEP 2145 D. Prior art must be considered in its entirety, including disclosures that teach away from the claims. A prior art reference that teaches away from the claimed invention is a significant factor to be considered in determining obviousness; the nature of the teaching is highly relevant and must be weighed in substance. *In re Gurley*, 27 F.3d 551, 554, 31 USPQ2d 1130, 1132 (Fed. Cir. 1994)

Because neither Poole nor Pacanowsky describe ammonium sulfate in *proximate and separate* relationship, that element of the claims is simply not present in either reference. When the references when taken alone or together fail to teach all of the elements of the claim, a prima facie case of obviousness is simply not supported.

For the reasons set forth above, neither Poole '588 nor Pacanowsky et al. '514 when taken alone or in combination teach, show, or suggest all of the elements recited in claim 27 of the present application. In addition, there is no suggestion in either reference to combine the teachings of each reference to thereby result in the invention as claimed, *even if all of the limitations were described within the references*. In the absence of a suggestion within the references, the examiner's conclusion of obviousness appears to be based on improper hindsight reasoning. As such, a prima facie case of obviousness of claim 27 over Poole in view of Pacanowsky has not been established, and the rejection of claim 27 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 27 allowed.

### CLAIM 29

Claim 29 recites:

"29. (previously presented) A vehicle occupant restraint system comprising:

- an inflatable air bag;
- a gas generator for inflating said air bag;
- a nonazide gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and
- a selective non-catalytic reducing compound placed proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds,

wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide and/or nitrogen dioxide produced upon combustion of said gas generant composition."

**A prima facie case of obviousness of claim 29 over Poole, U.S. Patent No. 5,139,588 in view of Pacanowsky et al., U.S. Patent No. 3,993,514 has not been established because the references, when combined, do not teach or suggest all the limitations of claim 29. Furthermore, neither Poole nor Pacanowsky provide the requisite suggestion within the references to combine the two references thereby resulting in the present invention.**

The examiner indicates that Poole et al. ('588) discloses a vehicle occupant restraint system; an inflatable air bag; a gas generator for inflating the air bag; a non azide gas generant composition within the gas generator that forms nitrogen oxide or dioxide upon combustion. The examiner acknowledges that '588 *does not disclose* a selective non-catalytic reducing (SNCR) compound, ammonium salt, placed with the gas generant composition, wherein at least one mol of ammonium sulfate is added per mol of nitrogen oxide or nitrogen

dioxide produced upon combustion of the gas generant composition. The applicants note that a gas generator is not explicitly discussed within '588.

Even if support for a teaching of a gas generator is arguably present, the applicants agree that Poole '588 neither teaches, nor suggests, nor motivates one of ordinary skill in the art *to provide an SNCR compound within a gas generator in heterogeneous relation to a gas generant composition within the gas generator*, wherein the selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds.

In fact, Poole '588 specifically describes another method of reducing the toxic gases NOx and CO:

“ *The invention importantly provides means of reducing the amount of the toxic gases NOx and CO in gas generant combustion products. This is accomplished by using an alkali metal salt mixed into the propellant.* The primary effect of the salt is to reduce the amount of NOx but this allows formulation of the gas generant to provide an excess of oxygen, in the combustion products, which reduces the amount of carbon monoxides as well as the NOx.

The invention contemplates application of these means to any gas generant which produces NOx and carbon monoxide.

The type of alkali metal compound used is important. While all alkali metals are likely to be effective in controlling NOx, potassium is the most preferred alkali metal because of its availability, low cost and effectiveness...” See Poole '588, Column 8, lines 39-55

As evident from the quoted text of '588, Poole clearly understood the problem of NOx and carbon monoxide in the gaseous effluent, and as such, solved the problem by *mixing an alkali metal salt* into the gas generant composition. There is no suggestion or motivation to approach the problem of NOx and carbon monoxide reduction in any other way, other than by mixing an alkali metal salt within the gas generant composition as explicitly taught as inventive by Poole.

Pacanowsky et al. '514 does not cure the deficiencies of Poole '588. The examiner indicates that it would have been obvious to one of ordinary skill in the art to modify the system of Poole et al. ('588) by adding a non-catalytic reducing compound of ammonium sulfate as disclosed by Pacanowsky et al. so as to change the flame temperature. The examiner fails to appreciate that Pacanowsky teaches *mixtures* of ammonium sulfate within the composition. Note '514 at column 2, lines 63-68:

“ *The present invention is predicated on the discovery* that the burning rate of gas generating compositions can be rendered substantially insensitive to the effects of compressive accelerative forces *by incorporating in the composition* a suitable amount of ammonium sulfate.” See Pacanowsky '514, column 2, lines 63-68.

It can therefore be concluded that Pacanowsky required a mixture, not a *proximate and separate* relationship, between ammonium sulfate and the gas generant composition, in accordance with claim 29. The ammonium sulfate *must* be incorporated in the composition, not loosely distributed about the gas generant composition.



The examiner urges that Pacanowsky '514 in fact "discloses the reducing compound discretely interspersed about the gas generant composition (citing col. 4 lines 53-68), and therefore, "it would be obvious to one of ordinary skill in the art at the time of the invention to further modify the system of Poole et al. ('588) as modified by Pacanowsky by interspersing as disclosed by Pacanowsky..."

This is simply not accurate as revealed by a careful reading of the portion of the text cited by the examiner in support of his position:

" In general, the present compositions comprise:

1. From 40% to 70% by weight of finely divided inorganic perchlorate oxidizer, preferably ammonium perchlorate,
2. From 10% to 35% of an elastomeric combustible fuel binder,
3. From 5% to 35% of an acceleration force desensitizer which is ammonium sulfate, and
4. From 0 to 10% by weight of the special purpose additives referred to above.

*In preparing the present compositions the perchlorate oxidizer in finely divided form and the liquid fuel binder and curing agent therefore, and the ammonium sulfate desensitizer also in finely divided form are placed in a mixer together with the special purpose additives if required and thoroughly mixed."* See Pacanowsky '514, column 4, lines 53-68.

As described by Pacanowsky, and in contradiction to what the examiner urges, ammonium sulfate is therefore thoroughly mixed within the gas generant composition, rather than in *proximate and separate* relation to the gas generant composition as required in claim 29.

In the advisory action dated January 17, 2007, the examiner in response to the applicants' request for reconsideration filed on December 26, 2007, indicates that the mixing time may vary and cites column 5, lines 10-5 in support of the argument that if the mixing time is short, then there would not be uniformity in the mixture, and therefore ammonium sulfate would be heterogeneous in relation to the other constituents in the composition. Again, Pacanowsky undercuts the examiner's conclusions in the very text cited by the examiner:

" The mixing time required to achieve the *desired degree of uniformity varies* according to the batch size and properties of the ingredients used such as viscosity of the fuel binder prepolymer, the nature of the curing agent, and particle size of the oxidizer and desensitizer. Ordinarily at least 30 minutes is required to achieve the desired uniformity. The mixed composition is introduced into a suitable casing..." See Pacanowsky '514, column 5, lines 1-8.

It should be emphasized that the "desired degree of uniformity" does not change, as suggested by the examiner. Rather, the "mixing time" varies according to the batch size and properties of the ingredients used such as viscosity and particle size. This makes sense. The composition cannot be "thoroughly mixed" and yet "not be uniformly mixed" as postulated by the examiner. Stated another way, there cannot be a "desired degree of uniformity" without uniform mixing. Again, note that "ordinarily at least 30 minutes is required to achieve

the desired uniformity”. Accordingly, Pacanowsky et al. is concerned with thoroughly mixing the composition, including ammonium sulfate, thereby ensuring the desired uniformity regardless of the properties of the constituents of the composition.

When viewed in proper context, Pacanowsky does not teach *proximate and separate* compositions while simultaneously teaching uniform compositions. The two notions are at opposite extremes and cannot exist together. Pacanowsky in fact teaches away from *proximate and separate* relationship between ammonium sulfate and the gas generant composition. When a reference teaches away, it cannot simultaneously suggest or teach the present invention. MPEP 2145 D. Prior art must be considered in its entirety, including disclosures that teach away from the claims. A prior art reference that teaches away from the claimed invention is a significant factor to be considered in determining obviousness; the nature of the teaching is highly relevant and must be weighed in substance. *In re Gurley*, 27 F.3d 551, 554, 31 USPQ2d 1130, 1132 (Fed. Cir. 1994)

Because neither Poole nor Pacanowsky describe ammonium sulfate in *proximate and separate* relationship to the gas generant, that element of the claims is simply not present in either reference. When the references when taken alone or together fail to teach all of the elements of the claim, a prima facie case of obviousness is simply not supported.

For the reasons set forth above, neither Poole ‘588 nor Pacanowsky et al. ‘514 when taken alone or in combination teach, show, or suggest all of the elements recited in claim 29 of the present application. In addition, there is no suggestion in either reference to combine the teachings of each reference to thereby result in the invention as claimed, *even if all of the limitations were described within the references*. In the absence of a suggestion within the references, the examiner’s conclusion of obviousness appears to be based on improper hindsight reasoning. As such, a prima facie case of obviousness of claim 29 over Poole in view of Pacanowsky has not been established, and the rejection of claim 29 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 29 allowed.

### **CLAIM 31**

Claim 31 recites:

- “31. A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a nitrogen-containing gas generant composition located within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and
  - a selective non-catalytic reducing compound placed proximate to and interspersed about said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts,

wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.”

**A prima facie case of obviousness of claim 31 over Poole, U.S. Patent No. 5,139,588 in view of Pacanowsky et al., U.S. Patent No. 3,993,514 has not been established because the references, when combined, do not teach or suggest all the limitations of claim 31. Furthermore, neither Poole nor Pacanowsky provide the requisite suggestion within the references to combine the two references thereby resulting in the present invention.**

The examiner indicates that Poole et al. ('588) discloses a vehicle occupant restraint system; an inflatable air bag; a gas generator for inflating the air bag; a nitrogen-containing gas generant composition within the gas generator that forms nitrogen oxide or dioxide upon combustion. The examiner acknowledges that '588 **does not disclose** a selective non-catalytic reducing (SNCR) compound, ammonium salt, placed with the gas generant composition, wherein at least one mol of ammonium sulfate is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of the gas generant composition. The applicants note that a gas generator is not explicitly discussed within '588.

Even if support for a teaching of a gas generator is arguably present, the applicants agree that Poole '588 neither teaches, nor suggests, nor motivates one of ordinary skill in the art **to provide an SNCR compound within a gas generator proximate to and interspersed about a gas generant composition within the gas generator**, wherein the selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds.

In fact, Poole '588 specifically describes another method of reducing the toxic gases NOx and CO:

“ **The invention importantly provides means of reducing the amount of the toxic gases NOx and CO in gas generant combustion products. This is accomplished by using an alkali metal salt mixed into the propellant.** The primary effect of the salt is to reduce the amount of NOx but this allows formulation of the gas generant to provide an excess of oxygen, in the combustion products, which reduces the amount of carbon monoxides as well as the NOx.

The invention contemplates application of these means to any gas generant which produces NOx and carbon monoxide.

The type of alkali metal compound used is important. While all alkali metals are likely to be effective in controlling NOx, potassium is the most preferred alkali metal because of its availability, low cost and effectiveness...” See Poole '588, Column 8, lines 39-55

As evident from the quoted text of '588, Poole clearly understood the problem of NOx and carbon monoxide in the gaseous effluent, and as such, solved the problem by **mixing an alkali metal salt** into the gas generant composition. There is no suggestion or motivation to approach the problem of NOx and carbon monoxide reduction in any other way, other than by mixing an alkali metal salt within the gas generant composition as explicitly taught as inventive by Poole.

Pacanowsky et al. '514 does not cure the deficiencies of Poole '588. The examiner indicates that it would have been obvious to one of ordinary skill in the art to modify the system of Poole et al. ('588) by adding a non-catalytic reducing compound of ammonium sulfate as disclosed by Pacanowsky et al. so as to change the flame temperature. The examiner fails to appreciate that Pacanowsky teaches *mixtures* of ammonium sulfate within the composition. Note '514 at column 2, lines 63-68:

“ *The present invention is predicated on the discovery* that the burning rate of gas generating compositions can be rendered substantially insensitive to the effects of compressive accelerative forces *by incorporating in the composition* a suitable amount of ammonium sulfate.” See Pacanowsky '514, column 2, lines 63-68.

It can therefore be concluded that Pacanowsky required a mixture, not a *proximate and interspersed* relationship, between ammonium sulfate and the gas generant composition, in accordance with claim 31. The ammonium sulfate *must* be incorporated in the composition, not loosely interspersed about the gas generant composition.

The examiner urges that Pacanowsky '514 in fact “discloses the reducing compound discretely interspersed about the gas generant composition (citing col. 4 lines 53-68), and therefore, “it would be obvious to one of ordinary skill in the art at the time of the invention to further modify the system of Poole et al. ('588) as modified by Pacanowsky by interspersing as disclosed by Pacanowsky...”.

This is simply not accurate as revealed by a careful reading of the portion of the text cited by the examiner in support of his position:

“ In general, the present compositions comprise:  
1. From 40% to 70% by weight of finely divided inorganic perchlorate oxidizer, preferably ammonium perchlorate,  
2. From 10% to 35% of an elastomeric combustible fuel binder,  
3. From 5% to 35% of an acceleration force desensitizer which is ammonium sulfate, and  
4. From 0 to 10% by weight of the special purpose additives referred to above.  
*In preparing the present compositions the perchlorate oxidizer in finely divided form and the liquid fuel binder and curing agent therefore, and the ammonium sulfate desensitizer also in finely divided form are placed in a mixer together with the special purpose additives if required and thoroughly mixed.*” See Pacanowsky '514, column 4, lines 53-68.

As described by Pacanowsky, and in contradiction to what the examiner urges, ammonium sulfate is therefore thoroughly mixed within the gas generant composition, rather than in a proximate and interspersed relation to the gas generant composition as required in claim 31.

In the advisory action dated January 17, 2007, the examiner in response to the applicants' request for reconsideration filed on December 26, 2007, indicates that the mixing time may vary and cites column 5, lines 10-5 in support of the argument that if the mixing time is short, then there would not be uniformity in the

mixture, and therefore ammonium sulfate would be in heterogeneous relation to the other constituents in the composition. Again, Pacanowsky undercuts the examiner's conclusions in the very text cited by the examiner:

“ The mixing time required to achieve the *desired degree of uniformity* varies according to the batch size and properties of the ingredients used such as viscosity of the fuel binder prepolymer, the nature of the curing agent, and particle size of the oxidizer and desensitizer. Ordinarily at least 30 minutes is required to achieve the desired uniformity. The mixed composition is introduced into a suitable casing...” See Pacanowsky ‘514, column 5, lines 1-8.

It should be emphasized that the “desired degree of uniformity” does not change, as suggested by the examiner. Rather, the “mixing time” varies according to the batch size and properties of the ingredients used such as viscosity and particle size. This makes sense. The composition cannot be “thoroughly mixed” and yet “not be uniformly mixed” as postulated by the examiner. Stated another way, there cannot be a “desired degree of uniformity” without uniform mixing. Again, note that “ordinarily at least 30 minutes is required to achieve the desired uniformity”. Accordingly, Pacanowsky et al. is concerned with thoroughly mixing the composition, including ammonium sulfate, thereby ensuring the desired uniformity regardless of the properties of the constituents of the composition.

When viewed in proper context, Pacanowsky does not teach heterogeneous compositions while simultaneously teaching uniform compositions. The two notions are at opposite extremes and cannot exist together. Pacanowsky in fact teaches away from proximate and interspersed relationship between ammonium sulfate and the gas generant composition. When a reference teaches away, it cannot simultaneously suggest or teach the present invention. MPEP 2145 D. Prior art must be considered in its entirety, including disclosures that teach away from the claims. A prior art reference that teaches away from the claimed invention is a significant factor to be considered in determining obviousness; the nature of the teaching is highly relevant and must be weighed in substance. *In re Gurley*, 27 F.3d 551, 554, 31 USPQ2d 1130, 1132 (Fed. Cir. 1994)

Because neither Poole nor Pacanowsky describe ammonium sulfate in proximate and interspersed relationship, that element of the claims is simply not present in either reference. When the references when taken alone or together fail to teach all of the elements of the claim, a prima facie case of obviousness is simply not supported.

For the reasons set forth above, neither Poole ‘588 nor Pacanowsky et al. ‘514 when taken alone or in combination teach, show, or suggest all of the elements recited in claim 31 of the present application. In addition, there is no suggestion in either reference to combine the teachings of each reference to thereby result in the invention as claimed, *even if all of the limitations were described within the references*. In the absence of a suggestion within the references, the examiner's conclusion of obviousness appears to be based on improper hindsight reasoning. As such, a prima facie case of obviousness of claim 31 over Poole in view of Pacanowsky

has not been established, and the rejection of claim 31 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 31 allowed.

**CLAIM 34**

Claim 34 recites:

“34. (previously presented) A vehicle occupant restraint system comprising:  
an inflatable air bag;  
a gas generator for inflating said air bag;  
a nitrogen-containing gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and  
a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds,  
wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.”

**A prima facie case of obviousness of claim 34 over Poole, U.S. Patent No. 5,139,588 in view of Pacanowsky et al., U.S. Patent No. 3,993,514 has not been established because the references, when combined, do not teach or suggest all the limitations of claim 34. Furthermore, neither Poole nor Pacanowsky provide the requisite suggestion within the references to combine the two references thereby resulting in the present invention.**

The examiner indicates that Poole et al. ('588) discloses a vehicle occupant restraint system; an inflatable air bag; a gas generator for inflating the air bag; a nitrogen-containing gas generant composition within the gas generator that forms nitrogen oxide or dioxide upon combustion. The examiner acknowledges that '588 **does not disclose** a selective non-catalytic reducing (SNCR) compound, ammonium salt, placed with the gas generant composition, wherein at least one mol of ammonium sulfate is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of the gas generant composition. The applicants note that a gas generator is not explicitly discussed within '588.

Even if support for a teaching of a gas generator is arguably present, the applicants agree that Poole '588 neither teaches, nor suggests, nor motivates one of ordinary skill in the art **to provide an SNCR compound within a gas generator in heterogeneous relation to a gas generant composition within the gas generator**, wherein the selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds.

In fact, Poole '588 specifically describes another method of reducing the toxic gases NOx and CO:

“ *The invention importantly provides means of reducing the amount of the toxic gases NOx and CO in gas generant combustion products. This is accomplished by using an alkali metal salt mixed into the propellant.* The primary effect of the salt is to reduce the amount of NOx but this allows formulation of the gas generant to provide an excess of oxygen, in the combustion products, which reduces the amount of carbon monoxides as well as the NOx.

The invention contemplates application of these means to any gas generant which produces NOx and carbon monoxide.

The type of alkali metal compound used is important. While all alkali metals are likely to be effective in controlling NOx, potassium is the most preferred alkali metal because of its availability, low cost and effectiveness...” See Poole '588, Column 8, lines 39-55

As evident from the quoted text of '588, Poole clearly understood the problem of NOx and carbon monoxide in the gaseous effluent, and as such, solved the problem by *mixing an alkali metal salt* into the gas generant composition. There is no suggestion or motivation to approach the problem of NOx and carbon monoxide reduction in any other way, other than by mixing an alkali metal salt within the gas generant composition as explicitly taught as inventive by Poole.

Pacanowsky et al. '514 does not cure the deficiencies of Poole '588. The examiner indicates that it would have been obvious to one of ordinary skill in the art to modify the system of Poole et al. ('588) by adding a non-catalytic reducing compound of ammonium sulfate as disclosed by Pacanowsky et al. so as to change the flame temperature. The examiner fails to appreciate that Pacanowsky teaches *mixtures* of ammonium sulfate within the composition. Note '514 at column 2, lines 63-68:

“ *The present invention is predicated on the discovery* that the burning rate of gas generating compositions can be rendered substantially insensitive to the effects of compressive accelerative forces *by incorporating in the composition* a suitable amount of ammonium sulfate.” See Pacanowsky '514, column 2, lines 63-68.

It can therefore be concluded that Pacanowsky required a mixture, not a *heterogeneous* relationship, between ammonium sulfate and the gas generant composition, in accordance with claim 34. The ammonium sulfate *must* be incorporated in the composition, not loosely distributed about the gas generant composition.

The examiner urges that Pacanowsky '514 in fact “discloses the reducing compound discretely interspersed about the gas generant composition (citing col. 4 lines 53-68), and therefore, “it would be obvious to one of ordinary skill in the art at the time of the invention to further modify the system of Poole et al. ('588) as modified by Pacanowsky by interspersing as disclosed by Pacanowsky...”.

This is simply not accurate as revealed by a careful reading of the portion of the text cited by the examiner in support of his position:

“ In general, the present compositions comprise:

1. From 40% to 70% by weight of finely divided inorganic perchlorate oxidizer, preferably ammonium perchlorate,
2. From 10% to 35% of an elastomeric combustible fuel binder,
3. From 5% to 35% of an acceleration force desensitizer which is ammonium sulfate, and
4. From 0 to 10% by weight of the special purpose additives referred to above.

***In preparing the present compositions the perchlorate oxidizer in finely divided form and the liquid fuel binder and curing agent therefore, and the ammonium sulfate desensitizer also in finely divided form are placed in a mixer together with the special purpose additives if required and thoroughly mixed.***” See Pacanowsky ‘514, column 4, lines 53-68.

As described by Pacanowsky, and in contradiction to what the examiner urges, ammonium sulfate is therefore thoroughly mixed within the gas generant composition, rather than in *heterogeneous* relation to the gas generant composition as required in claim 34.

In the advisory action dated January 17, 2007, the examiner in response to the applicants’ request for reconsideration filed on December 26, 2007, indicates that the mixing time may vary and cites column 5, lines 10-5 in support of the argument that if the mixing time is short, then there would not be uniformity in the mixture, and therefore ammonium sulfate would be heterogeneous in relation to the other constituents in the composition. Again, Pacanowsky undercuts the examiner’s conclusions in the very text cited by the examiner:

“ The mixing time required to achieve the *desired degree of uniformity* varies according to the batch size and properties of the ingredients used such as viscosity of the fuel binder prepolymer, the nature of the curing agent, and particle size of the oxidizer and desensitizer. Ordinarily at least 30 minutes is required to achieve the desired uniformity. The mixed composition is introduced into a suitable casing...” See Pacanowsky ‘514, column 5, lines 1-8.

It should be emphasized that the “desired degree of uniformity” does not change, as suggested by the examiner. Rather, the “mixing time” varies according to the batch size and properties of the ingredients used such as viscosity and particle size. This makes sense. The composition cannot be “thoroughly mixed” and yet “not be uniformly mixed” as postulated by the examiner. Stated another way, there cannot be a “desired degree of uniformity” without uniform mixing. Again, note that “ordinarily at least 30 minutes is required to achieve the desired uniformity”. Accordingly, Pacanowsky et al. is concerned with thoroughly mixing the composition, including ammonium sulfate, thereby ensuring the desired uniformity regardless of the properties of the constituents of the composition.

When viewed in proper context, Pacanowsky does not teach heterogeneous compositions while simultaneously teaching uniform compositions. The two notions are at opposite extremes and cannot exist together. Pacanowsky in fact teaches away from heterogeneous relationship between ammonium sulfate and the gas generant composition. When a reference teaches away, it cannot simultaneously suggest or teach the present invention. MPEP 2145 D. Prior art must be considered in its entirety, including disclosures that teach away



from the claims. A prior art reference that teaches away from the claimed invention is a significant factor to be considered in determining obviousness; the nature of the teaching is highly relevant and must be weighed in substance. *In re Gurley*, 27 F.3d 551, 554, 31 USPQ2d 1130, 1132 (Fed. Cir. 1994)

Because neither Poole nor Pacanowsky describe ammonium sulfate in heterogeneous relationship, that element of the claims is simply not present in either reference. When the references when taken alone or together fail to teach all of the elements of the claim, a prima facie case of obviousness is simply not supported.

For the reasons set forth above, neither Poole '588 nor Pacanowsky et al. '514 when taken alone or in combination teach, show, or suggest all of the elements recited in claim 34 of the present application. In addition, there is no suggestion in either reference to combine the teachings of each reference to thereby result in the invention as claimed, *even if all of the limitations were described within the references*. In the absence of a suggestion within the references, the examiner's conclusion of obviousness appears to be based on improper hindsight reasoning. As such, a prima facie case of obviousness of claim 34 over Poole in view of Pacanowsky has not been established, and the rejection of claim 34 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 34 allowed.

#### **CLAIM 35**

"35. The vehicle occupant restraint system of claim 34 wherein said gas generant composition is extruded into a desirable shape and upon combustion yields gases comprising NO<sub>x</sub> gas, and, said reducing compound contains at least one mole of elemental nitrogen per one mole of NO<sub>x</sub> produced by the gas generant composition upon combustion and is discretely interspersed about the gas generant composition."

The remarks set forth with regard to the patentability of claim 34 in response to the rejection under 35 U.S.C. §103(a) over Poole '588 in view of Pacanowsky et al. '514 are equally applicable with regard to the rejection of claim 35, and are incorporated herein by reference as if fully stated. Also, as stated previously, a prima facie case of obviousness of claim 35 in view of the cited references has not been established. In addition, if an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Thus, as claim 34 is deemed nonobvious, and as claim 35 depends from claim 34, claim 35 should also be deemed nonobvious. For these reasons, the rejection of claim 35 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 35 allowed.

#### **CLAIM 36**

"36. The vehicle occupant restraint system of claim 34 wherein said gas generant composition comprises at least one material of each of the following functional groups of materials – a) a fuel selected from the group of azole compounds consisting of triazole, aminotetrazole, tetrazole, bitetrazole, and metal salts of these compounds; b) an

oxygen containing oxidizer compound selected from the group consisting of alkali metal, alkaline earth metal, lanthanide and ammonium nitrates and perchlorates or from the group consisting of alkali metal and alkaline earth metal chlorates and peroxides; and c) a low-temperature slag forming material which is sufficient in amount during combustion to cause the solid combustion particles to coalesce into easily filterable slag or clinkers but not so much as to make a low viscosity liquid, selected from the group consisting of silicon dioxide, boric oxide and vanadium pentoxide or from the group consisting of alkali metal silicates, borates, and carbonates or from the group consisting of naturally occurring clays and talcs, and, the gas generant composition is extruded into a desirable shape and combusts to yield gases comprising NO<sub>x</sub> gases, and, the reducing compound contains at least one mole of elemental nitrogen per one mole of NO<sub>x</sub> produced by the gas generating mixture upon combustion, and is interspersed about the gas generant composition.”

The remarks set forth with regard to the patentability of claim 34 in response to the rejection under 35 U.S.C. §103(a) over Poole ‘588 in view of Pacanowsky et al. ‘514 are equally applicable with regard to the rejection of claim 36, and are incorporated herein by reference as if fully stated. Also, as stated previously, a prima facie case of obviousness of claim 36 in view of the cited references has not been established. In addition, if an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Thus, as claim 34 is deemed nonobvious, and as claim 36 depends from claim 34, claim 36 should also be deemed nonobvious. For these reasons, the rejection of claim 36 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 36 allowed.

### **CLAIM 37**

“37. The vehicle occupant restraint system of claim 34 wherein said nitrogen-containing gas generant composition produces nitrogen oxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.”

The remarks set forth with regard to the patentability of claim 34 in response to the rejection under 35 U.S.C. §103(a) over Poole ‘588 in view of Pacanowsky et al. ‘514 are equally applicable with regard to the rejection of claim 37, and are incorporated herein by reference as if fully stated. Also, as stated previously, a prima facie case of obviousness of claim 37 in view of the cited references has not been established. In addition, if an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Thus, as claim 34 is deemed nonobvious, and as claim 37 depends from claim 34, claim 37 should also be deemed nonobvious. Furthermore, neither Poole nor Pacanowsky when taken alone or in combination teach or suggest the proximate and heterogeneously

interspersed relationship between the SNCR compound and the gas generant composition. For these reasons, the rejection of claim 37 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 37 allowed.

#### **CLAIM 38**

"38. The vehicle occupant restraint system of claim 35 wherein said nitrogen-containing gas generant composition produces nitrogen oxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition."

The remarks set forth with regard to the patentability of claim 34 in response to the rejection under 35 U.S.C. §103(a) over Poole '588 in view of Pacanowsky et al. '514 are equally applicable with regard to the rejection of claim 38, and are incorporated herein by reference as if fully stated. Also, as stated previously, a prima facie case of obviousness of claim 38 in view of the cited references has not been established. In addition, if an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Thus, as claim 34 is deemed nonobvious, and as claim 38 depends from claim 35 which depends from claim 34, claim 38 should also be deemed nonobvious. Furthermore, neither Poole nor Pacanowsky when taken alone or in combination teach or suggest the proximate and heterogeneously interspersed relationship between the SNCR compound and the gas generant composition. For these reasons, the rejection of claim 38 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 38 allowed.

#### **CLAIM 39**

"39. The vehicle occupant restraint system of claim 36 wherein said nitrogen-containing gas generant composition produces nitrogen oxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition."

The remarks set forth with regard to the patentability of claim 34 in response to the rejection under 35 U.S.C. §103(a) over Poole '588 in view of Pacanowsky et al. '514 are equally applicable with regard to the rejection of claim 39, and are incorporated herein by reference as if fully stated. Also, as stated previously, a prima facie case of obviousness of claim 39 in view of the cited references has not been established. In addition,

if an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Thus, as claim 34 is deemed nonobvious, and as claim 39 depends from claim 36 which depends from claim 34, claim 39 should also be deemed nonobvious. Furthermore, neither Poole nor Pacanowsky when taken alone or in combination teach or suggest the proximate and heterogeneously interspersed relationship between the SNCR compound and the gas generant composition. For these reasons, the rejection of claim 39 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 39 allowed.

#### **CLAIM 40**

- “40. A vehicle occupant restraint system of Claim 34 wherein:  
said selective non-catalytic reducing compound is selected from the group consisting of ammonium carbonate ((NH<sub>4</sub>)<sub>2</sub>CO<sub>3</sub>), ammonium sulfate ((NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>), ammonium chloride (NH<sub>4</sub>Cl), ammonium carbamate (H<sub>2</sub>NCO<sub>2</sub>NH<sub>4</sub>), and ammonium fluoride (NH<sub>4</sub>F).”

The remarks set forth with regard to the patentability of claim 34 in response to the rejection under 35 U.S.C. §103(a) over Poole ‘588 in view of Pacanowsky et al. ‘514 are equally applicable with regard to the rejection of claim 40, and are incorporated herein by reference as if fully stated. Also, as stated previously, a prima facie case of obviousness of claim 40 in view of the cited references has not been established. In addition, if an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Thus, as claim 34 is deemed nonobvious, and as claim 40 depends from claim 34, claim 40 should also be deemed nonobvious. For these reasons, the rejection of claim 40 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 40 allowed.

#### **CLAIM 41**

- “41. The vehicle occupant restraint system of claim 21 wherein said selective non-catalytic reducing compound is ammonium sulfate.”

The remarks set forth with regard to the patentability of claim 21 in response to the rejection under 35 U.S.C. §103(a) over Poole ‘588 in view of Pacanowsky et al. ‘514 are equally applicable with regard to the rejection of claim 41, and are incorporated herein by reference as if fully stated. Also, as stated previously, a prima facie case of obviousness of claim 41 in view of the cited references has not been established. In addition, if an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Thus, as claim 21 is deemed nonobvious, and as claim 41 depends from claim 21, claim 41 should also be deemed nonobvious. For these reasons, the rejection

of claim 41 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 41 allowed.

**CLAIM 42**

“42. The vehicle occupant restraint system of claim 23 wherein said selective non-catalytic reducing compound is ammonium sulfate.”

The remarks set forth with regard to the patentability of claim 23 in response to the rejection under 35 U.S.C. §103(a) over Poole ‘588 in view of Pacanowsky et al. ‘514 are equally applicable with regard to the rejection of claim 42, and are incorporated herein by reference as if fully stated. Also, as stated previously, a prima facie case of obviousness of claim 42 in view of the cited references has not been established. In addition, if an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Thus, as claim 23 is deemed nonobvious, and as claim 42 depends from claim 23, claim 42 should also be deemed nonobvious. For these reasons, the rejection of claim 42 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 42 allowed.

**CLAIM 43**

“43. The vehicle occupant restraint system of claim 25 wherein the gas generant composition is a nonazide gas generant composition and the selective non-catalytic reducing compound is ammonium sulfate.”

The remarks set forth with regard to the patentability of claim 25 in response to the rejection under 35 U.S.C. §103(a) over Poole ‘588 in view of Pacanowsky et al. ‘514 are equally applicable with regard to the rejection of claim 43, and are incorporated herein by reference as if fully stated. Also, as stated previously, a prima facie case of obviousness of claim 43 in view of the cited references has not been established. In addition, if an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Thus, as claim 25 is deemed nonobvious, and as claim 43 depends from claim 25, claim 43 should also be deemed nonobvious. For these reasons, the rejection of claim 43 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 43 allowed.

**CLAIM 44**

“44. The vehicle occupant restraint system of claim 27 wherein the gas generant composition is a nonazide gas generant composition and the selective non-catalytic reducing compound is ammonium sulfate.”

The remarks set forth with regard to the patentability of claim 27 in response to the rejection under 35 U.S.C. §103(a) over Poole ‘588 in view of Pacanowsky et al. ‘514 are equally applicable with regard to the

rejection of claim 44, and are incorporated herein by reference as if fully stated. Also, as stated previously, a prima facie case of obviousness of claim 44 in view of the cited references has not been established. In addition, if an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Thus, as claim 27 is deemed nonobvious, and as claim 44 depends from claim 27, claim 44 should also be deemed nonobvious. For these reasons, the rejection of claim 44 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 44 allowed.

#### **CLAIM 45**

"45. The vehicle occupant restraint system of claim 29 wherein said selective non-catalytic reducing compound is ammonium sulfate."

The remarks set forth with regard to the patentability of claim 29 in response to the rejection under 35 U.S.C. §103(a) over Poole '588 in view of Pacanowsky et al. '514 are equally applicable with regard to the rejection of claim 45, and are incorporated herein by reference as if fully stated. Also, as stated previously, a prima facie case of obviousness of claim 45 in view of the cited references has not been established. In addition, if an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Thus, as claim 29 is deemed nonobvious, and as claim 45 depends from claim 29, claim 45 should also be deemed nonobvious. For these reasons, the rejection of claim 45 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 45 allowed.

#### **CLAIM 46**

"46. The vehicle occupant restraint system of claim 31 wherein said gas generant composition is a nonazide composition and said selective non-catalytic reducing compound is ammonium sulfate."

The remarks set forth with regard to the patentability of claim 31 in response to the rejection under 35 U.S.C. §103(a) over Poole '588 in view of Pacanowsky et al. '514 are equally applicable with regard to the rejection of claim 46, and are incorporated herein by reference as if fully stated. Also, as stated previously, a prima facie case of obviousness of claim 46 in view of the cited references has not been established. In addition, if an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Thus, as claim 31 is deemed nonobvious, and as claim 46 depends from claim 31, claim 46 should also be deemed nonobvious. For these reasons, the rejection of claim 46 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 46 allowed.

#### **CLAIM 47**

"47. The vehicle occupant restraint system of Claim 31 wherein:

said selective non-catalytic reducing compound is selected from the group consisting of ammonium carbonate ((NH<sub>4</sub>)<sub>2</sub>CO<sub>3</sub>), ammonium sulfate ((NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>), ammonium chloride (NH<sub>4</sub>Cl), ammonium carbamate (H<sub>2</sub>NCO<sub>2</sub>NH<sub>4</sub>), and ammonium fluoride (NH<sub>4</sub>F)."

The remarks set forth with regard to the patentability of claim 31 in response to the rejection under 35 U.S.C. § 103(a) over Poole '588 in view of Pacanowsky et al. '514 are equally applicable with regard to the rejection of claim 47, and are incorporated herein by reference as if fully stated. Also, as stated previously, a prima facie case of obviousness of claim 47 in view of the cited references has not been established. In addition, if an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Thus, as claim 31 is deemed nonobvious, and as claim 47 depends from claim 31, claim 47 should also be deemed nonobvious. For these reasons, the rejection of claim 47 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 47 allowed.

Finally, the applicants traverse the examiner's contentions in the final rejection of 9/25/06 that the compositions described in Poole and Pacanowsky are the same as the present invention. As detailed above, Poole and Pacanowsky describe intimate mixtures of gas generants with alkali metal salts, and gas generants with ammonium sulfate, respectively. On the other hand, the applicants describe the use of a gas generant composition in heterogeneous, or, proximate and separate, relationship with an SNCR compound interspersed about the gas generant. As stated throughout the application, the use of the SNCR agent in this manner mitigates the necessity to redesign vehicle occupant protection systems as NO<sub>x</sub> and CO criteria changes. As a result, proven systems may continue to be employed by simply providing an SNCR compound in heterogeneous, or proximate and separate, relationship with the gas generant composition. Accordingly, there is no suggestion or motivation of the present invention as claimed in the cited references.

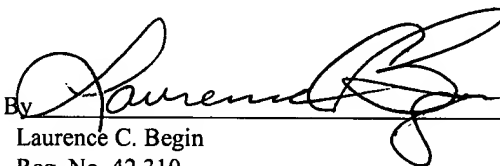
For the above-stated reasons, the Examiner has simply not met the burden of establishing a prima facie case of obviousness relative to claims 21, 23, 25, 27, 29, 31, and 34-47 over Poole '588 in view of Pacanowsky et al. '514. Thus, the §103(a) rejections of independent claims 21, 23, 25, 27, 29, 31, and 34, and the dependent claims 35-47, are incorrect and should be reversed.

Accordingly, reversal of the Examiner's rejections of claims 21, 23, 25, 27, 29, 31, and 34-47, and issuance of the present application is courteously solicited.

For the reasons stated, the Applicants traverse the rejections as discussed herein, and courteously solicit allowance of the claims, and passage of the subject application to issue.

Submitted herewith is a credit card authorization sheet to charge the amount of \$620 to cover a one-month extension fee and petition thereof, and the cost of filing this brief in support of the appeal. The Commissioner is authorized to charge any deficiencies (or credit any overage) related to this paper to deposit account no. 50-3238.

Respectfully submitted,

By 

Laurence C. Begin  
Reg. No. 42,310  
Phone (248) 889-5875  
FAX (248) 887-7664



(viii) Claims Appendix

21. A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a nitrogen-containing gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and
  - a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds,
- wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.
23. (previously presented) A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a nitrogen-containing nonazide gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and
  - a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds,
- wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.
25. A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and
  - a selective non-catalytic reducing compound proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts

and amine-containing compounds,  
wherein at least one mol of the selective non-catalytic reducing compound is added per mol of  
nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant  
composition.

27. A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and
  - a selective non-catalytic reducing compound placed proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds,
- wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

29. A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a nonazide gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and
  - a selective non-catalytic reducing compound placed proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds,
- wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide and/or nitrogen dioxide produced upon combustion of said gas generant composition.

31. A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a nitrogen-containing gas generant composition located within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and
  - a selective non-catalytic reducing compound placed proximate to and interspersed about said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts,

wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

34. A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a nitrogen-containing gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and
  - a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds,
- wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

35. The vehicle occupant restraint system of claim 34 wherein said gas generant composition is extruded into a desirable shape and upon combustion yields gases comprising  $\text{NO}_x$  gas, and, said reducing compound contains at least one mole of elemental nitrogen per one mole of  $\text{NO}_x$  produced by the gas generant composition upon combustion and is discretely interspersed about the gas generant composition.

36. The vehicle occupant restraint system of claim 34 wherein said gas generant composition comprises at least one material of each of the following functional groups of materials – a) a fuel selected from the group of azole compounds consisting of triazole, aminotetrazole, tetrazole, bitetrazole, and metal salts of these compounds; b) an oxygen containing oxidizer compound selected from the group consisting of alkali metal, alkaline earth metal, lanthanide and ammonium nitrates and perchlorates or from the group consisting of alkali metal and alkaline earth metal chlorates and peroxides; and c) a low-temperature slag forming material which is sufficient in amount during combustion to cause the solid combustion particles to coalesce into easily filterable slag or clinkers but not so much as to make a low viscosity liquid, selected from the group consisting of silicon dioxide, boric oxide and vanadium pentoxide or from the group consisting of alkali metal silicates, borates, and carbonates or from the group consisting of naturally occurring clays and talcs, and, the gas generant composition is extruded into a desirable shape and combusts to yield gases comprising  $\text{NO}_x$  gases, and, the reducing compound contains at least one mole of elemental nitrogen per one mole of  $\text{NO}_x$  produced by the gas generating mixture upon combustion, and is interspersed about the gas generant composition.

37. The vehicle occupant restraint system of claim 34 wherein said nitrogen-containing gas generant

composition produces nitrogen oxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

38. The vehicle occupant restraint system of claim 35 wherein said nitrogen-containing gas generant composition produces nitrogen oxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

39. The vehicle occupant restraint system of claim 36 wherein said nitrogen-containing gas generant composition produces nitrogen oxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

40. A vehicle occupant restraint system of Claim 34 wherein:  
said selective non-catalytic reducing compound is selected from the group consisting of ammonium carbonate  $((\text{NH}_4)_2\text{CO}_3)$ , ammonium sulfate  $((\text{NH}_4)_2\text{SO}_4)$ , ammonium chloride  $(\text{NH}_4\text{Cl})$ , ammonium carbamate  $(\text{H}_2\text{NCO}_2\text{NH}_4)$ , and ammonium fluoride  $(\text{NH}_4\text{F})$ .

41. The vehicle occupant restraint system of claim 21 wherein said selective non-catalytic reducing compound is ammonium sulfate.

42. The vehicle occupant restraint system of claim 23 wherein said selective non-catalytic reducing compound is ammonium sulfate.

43. The vehicle occupant restraint system of claim 25 wherein the gas generant composition is a nonazide gas generant composition and the selective non-catalytic reducing compound is ammonium sulfate.

44. The vehicle occupant restraint system of claim 27 wherein the gas generant composition is a nonazide gas generant composition and the selective non-catalytic reducing compound is ammonium sulfate.

45. The vehicle occupant restraint system of claim 29 wherein said selective non-catalytic reducing compound is ammonium sulfate.

46. The vehicle occupant restraint system of claim 31 wherein said gas generant composition is a nonazide composition and said selective non-catalytic reducing compound is ammonium sulfate.

47. The vehicle occupant restraint system of Claim 31 wherein:

said selective non-catalytic reducing compound is selected from the group consisting of ammonium carbonate ((NH<sub>4</sub>)<sub>2</sub>CO<sub>3</sub>), ammonium sulfate ((NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>), ammonium chloride (NH<sub>4</sub>Cl), ammonium carbamate (H<sub>2</sub>NCO<sub>2</sub>NH<sub>4</sub>), and ammonium fluoride (NH<sub>4</sub>F).

**(ix) Evidence Appendix**

- Appendix A:** Application Serial No. 09/638,606, filed on August 15, 2000
- Appendix B:** Office Action Responses From 8/21/01-8/21/03
- Appendix C:** Amendment of 8/4/04 and Expert Declaration of Dr. Graylon K. Williams
- Appendix D:** All Office Action Responses From 12/13/04-2/7/06
- Appendix E:** All Office Actions Prior to 2/24/06
- Appendix F:** Office Action of 2/24/06
- Appendix G:** Response to Office Action of 2/24/06 As Filed 6/26/06
- Appendix H:** Final Office Action of 9/25/06
- Appendix I:** Cited References:
- 1) Pacanowsky et al., U.S. Patent No. 3,993,514
  - 2) Poole, U.S. Patent No. 5,139,588
- Appendix J:** Request For Reconsideration Filed 12/26/06
- Appendix K:** Advisory Action Dated 1/17/07
- Appendix L:** Notice of Appeal Filed 1/25/07

Serial No. 09/638,606  
Appeal Brief

Atty. Dkt. No. 5702-00007

**(x) Related Proceedings Appendix**

NONE

## **Appendix A**

**Application Serial No. 09/638,606,  
filed on August 15, 2000**



**SELECTIVE NON-CATALYTIC REDUCTION (SNCR) OF TOXIC  
GASEOUS EFFLUENTS**

CROSS-REFERENCE TO RELATED APPLICATIONS

5 This application is a continuation-in-part of copending U.S.  
Application Serial No. 08/695,954 filed on August 12, 1996.

BACKGROUND OF THE INVENTION

10 The present invention relates generally to gas generators, those  
used in inflatable occupant safety restraints in motor vehicles and aircraft for  
example, and more particularly to reducing the toxicity of effluent gases  
produced by nitrogen-containing gas generating compositions.

15 Inflatable occupant restraint devices for motor vehicles have been  
under development worldwide for many years, including the development of gas  
generating compositions for inflating such occupant restraints. Because the  
inflating gases produced by the gas generants must meet strict toxicity  
requirements, many gas generants now in use are based on alkali or alkaline  
earth metal azides, particularly sodium azide. When reacted with an oxidizing  
agent, sodium azide forms a relatively nontoxic gas consisting primarily of  
20 nitrogen.

25 However, azide-based gas generants are inherently volatile to  
handle and entail relatively high risk in manufacture and disposal. Stated  
another way, the inflating gases produced by azide-based gas generants are  
relatively nontoxic while the metal azides themselves are conversely highly  
toxic, thereby resulting in extra expense and risk in gas generant manufacture,  
storage, and disposal. In addition to direct contamination of the environment,  
metal azides also readily react with acids and heavy metals to form extremely  
sensitive compounds that may spontaneously ignite or detonate.

30 In contradistinction, nonazide gas generants, such as those  
disclosed in U.S. Patent Nos. 5,035,757 and 5,139,588 to Poole (each herein  
incorporated by reference), typically comprise a nitrogen-containing nonazide

fuel selected from the group of tetrazole compounds and/or metal salts thereof and an oxidizer. "Nonazide" gas generant compositions provide significant advantages over azide-based gas generants by reducing toxicity-related hazards during manufacture and disposal. Moreover, most nonazide gas generants typically supply a higher yield of gas (moles of gas per gram of gas generant) than conventional azide-based gas generants.

However, many nonazide gas generants heretofore known and used produce relatively high levels of toxic substances upon combustion as compared to azide-based gas generants. The most difficult toxic gases to control are the various oxides of nitrogen ( $\text{NO}_x$ ) and carbon monoxide (CO). At present, nitrogen monoxide at 75 ppm or less and nitrogen dioxide at 10 ppm or less is generally acceptable. Because the gas generant of the passenger-side airbags is generally four times greater in quantity than that of the driver-side, the need for  $\text{NO}_x$  and CO reduction is most keenly felt when designing passenger-side airbags. Nevertheless, the concern exists for other inflator systems within the vehicle as well.

Reduction of the level of toxic  $\text{NO}_x$  and CO upon combustion of nonazide gas generants has proven to be a difficult problem. For instance, manipulation of the oxidizer/fuel ratio only reduces either the  $\text{NO}_x$  or CO. More specifically, increasing the ratio of oxidizer to fuel minimizes the CO content upon combustion because the extra oxygen oxidizes the CO to carbon dioxide. Unfortunately, however, this approach results in increased amounts of  $\text{NO}_x$ . Alternatively, if the oxidizer/fuel ratio is lowered to eliminate excess oxygen and reduce the amount of  $\text{NO}_x$  produced, increased amounts of CO are produced.

One way to improve the toxicity of the combustion gases is to reduce the combustion temperature that would reduce the initial concentrations of both CO and  $\text{NO}_x$ . Although simple in theory, it is difficult in practice to reduce the combustion temperature and to also retain a sufficiently high gas generant burn rate for practical application in an inflatable vehicle occupant restraint system. The burn rate of the gas generant is important to ensure that

the inflator will operate readily and properly. As a general rule, the burn rate of the gas generant decreases as the combustion temperature decreases. By using less energetic fuels, specifically fuels that produce less heat upon combustion, the combustion temperature may be reduced but the gas generant burn rate is also reduced.

Finally, as restrictions on  $\text{NO}_x$  emissions become more stringent, many gas generators, for example those currently used in occupant restraint systems, must be redesigned to reduce  $\text{NO}_x$  emissions. This often requires redesign of contemporary inflators, gas generators, and gas generants. The costs can be substantial. Reducing the  $\text{NO}_x$  without absorbing these costs would certainly be an improvement in the art.

Therefore, a need exists for reducing the toxicity of effluent gases produced by nonazide gas generants without substantially changing the combustion properties or reaction kinetics of the gas generant.

#### SUMMARY OF THE INVENTION

The aforesaid problems are solved by a gas generator that contains an ignition compound and a nontoxic, nonazide and pyrotechnic gas generating mixture. When employed with a selective non-catalytic reducing (SNCR) compound, the gas generant upon combustion produces inflating gases that have reduced levels of nitrogen oxides ( $\text{NO}_x$ ) and carbon monoxide (CO).

In accordance with the present invention, SNCR compounds are selected from the group of ammonia derivatives such as ammonium salts, amines, amides, and imides. The SNCR compound is generally employed in an amount wherein each mol of NO resulting from combustion of the gas generant will correspond to at least one mol of nitrogen contained within an  $\text{NH}_x$  (e.g.  $x=2, 3$ , or  $4$ ) group of an SNCR compound.

Stated another way, the SNCR compound is generally only provided in the gas generant bed if the gas generant tablets, extrusions, or other desired shapes contain elemental nitrogen and therefore produce relatively high levels of nitrogen oxides such as nitrogen monoxide and/or nitrogen dioxide upon combustion. One of ordinary skill will appreciate that many well-known nonazide gas generants exhibit these general requirements.

A "nonazide gas generant composition" is any nitrogen-containing gas generant composition having blended constituents or compounds that do not contain the functional group or characteristic formula known as azide. Azide is represented by  $R(N_3)_x$  wherein R may be almost any metal atom, a hydrogen atom, a halogen atom, the ammonium radical, a complex, an organic radical like methyl, phenyl, nitrophenol, dinitrophenol, p-nitrobenzyl, ethyl nitrate, etc., and a variety of other groups or radicals. Preferred nonazide gas generants include those described in U.S. Patent Nos. 5,035,757 and 5,139,588.

More specifically, the present invention comprises a nonazide gas generant composition, and a separate or discrete  $NO_x$  reducing agent that theoretically liberates  $NH_2$  radicals upon thermal decomposition and/or reaction with  $O_2$ . It is believed that the  $NO_x$  gases generated from the combustion of the gas generant, such as NO and/or  $NO_2$ , selectively react with the  $NH_2$  radical, or  $NH_3$  and  $O_2$ , thereby producing a harmless gas of  $N_2$ . A corresponding reduction in CO is an incidental benefit with the use of some of the reducing agents, such as  $(NH_4)_2SO_4$ . In addition, the chemistry of the SNCR chemical is noninvasive. "Noninvasive", as understood in the art, is defined to mean that the addition of the SNCR chemical to the gas generant bed will not substantially interfere with the expected performance, reaction kinetics, or stability of the gas generant composition when it is combusted.

Thus, the present invention facilitates the use of known inflator systems that, when used without an SNCR agent, potentially exhibit  $NO_x$  combustion levels in excess of present original equipment manufacturer (OEM)

requirements. As a result, redesign, retooling, and remanufacturing of known inflators is not required notwithstanding excessive respective  $\text{NO}_x$  combustion levels absent the SNCR system.

5                    DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

10                   In accordance with the present invention, a vehicle occupant restraint device utilizing an SNCR system comprises a gas generator, a gas generating composition and a de- $\text{NO}_x$  agent. In general, the gas generating composition can be described as a nitrogen-containing homogeneous mixture of a fuel and an oxidizer, and more preferably, a nonazide nitrogen-containing gas generating composition. Nonazide gas generating compositions are well known in the art. U.S. Patent Nos. 5,035,757 and 5,139,588 exemplify but do not limit the gas generant compositions contemplated. In accordance with the present invention, nitrogen oxides (including nitrogen monoxide and/or nitrogen dioxide) must be produced upon combustion of the gas generating composition. As one of ordinary skill will appreciate, analysis of the combustion products, by theoretical calculations, by Fourier Transform Infrared Spectroscopy (FTIR), and/or by Chemiluminescence, for example, is a normal part of the design process thereby ensuring compliance with OEM air quality requirements.

20                   Therefore, one of ordinary skill in the art will readily appreciate those compositions producing  $\text{NO}_x$ .

25                   The de- $\text{NO}_x$  agent (or SNCR agent), preferably provided at 0.01-4.0% (and more preferably at 0.1-3.0%) by weight of the total weight of the gas generant, is heterogeneously disposed around the periphery of the gas generant within the gas generant bed. The SNCR agent is selected from a group including ammonium compounds such as ammonium salts, amine-containing compounds having an  $-\text{NH}_2$  group, or any compound which theoretically produces an  $\text{NH}_2$  radical or an  $\text{NH}_3$  molecule in the gas phase. Stated another way, the SNCR agent is sprinkled or distributed about the gas generant in heterogeneous relation thereto. Alternatively, the SNCR agent may

30

be provided within one or more tea bags placed in contact with and proximate to the gas generant. The tea bags are supplied, for example, by Dexter Corporation in Windsor Locks, Connecticut and are made from a special blend of thermoplastic fibers, manila hemp and other selected cellulose fibers.

5           Examples of ammonium salts include ammonium carbonate  $((\text{NH}_4)_2\text{CO}_3)$ , ammonium sulfate  $((\text{NH}_4)_2\text{SO}_4)$ , ammonium chloride  $(\text{NH}_4\text{Cl})$ , ammonium carbamate  $(\text{H}_2\text{NCO}_2\text{NH}_4)$ , and ammonium fluoride  $(\text{NH}_4\text{F})$ . Urea  $(\text{H}_2\text{NCONH}_2)$  and cyanuric acid  $((\text{HNCO})_3)$  also exemplify SNCR agents in accordance with the present invention. Given the aforementioned benefits, the  
10 gas generant is preferably nonazide, although other nitrogen-containing gas generants such as an azide-based composition may be utilized in conjunction with SNCR. The SNCR chemical is preferably ammonium sulfate  $((\text{NH}_4)_2\text{SO}_4)$  based on the unexpected results given in Example 3 below. Not only does  $(\text{NH}_4)_2\text{SO}_4$  inhibit production of toxic  $\text{NO}_2$ , it actually reduces  $\text{NO}_2$  over time. Based on analysis of combustion gases, it is believed that ammonium salts will generate the highest yield of  $\text{NH}_2$  radicals.

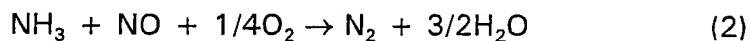
In general, preferred nonazide nitrogen-containing gas generant compositions (described in U.S. Patent No. 5,139,588) contain at least one material of each of the following functional groups of materials: a) a fuel  
20 selected from the group of azole compounds consisting of triazole, aminotetrazole, tetrazole, bitetrazole, and metal salts of these compounds at 22 to about 36% by weight; b) an oxygen containing oxidizer compound selected from the group consisting of alkali metal, alkaline earth metal, lanthanide and ammonium nitrates and perchlorates or from the group consisting of alkali metal  
25 and alkaline earth metal chlorates and peroxides at 38 to about 62% by weight; and c) a low-temperature slag forming material which is sufficient in amount during combustion to cause the solid combustion particles to coalesce into easily filterable slag or clinkers but not so much as to make a low viscosity liquid, selected from the group consisting of silicon dioxide, boric oxide and  
30 vanadium pentoxide or from the group consisting of alkali metal silicates,

borates, and carbonates or from the group consisting of naturally occurring clays and talcs, at 2 to 18% by weight of the total gas generant.

In theory, it is believed that selective non-catalytic reduction (SNCR) employs an  $\text{NH}_2$  radical that selectively reacts with nitrogen oxide (NO) in the gas phase to form non-toxic nitrogen gas ( $\text{N}_2$ ). In an SNCR system, it is believed that basic requirements for the reduction of NO by an SNCR chemical include a well-mixed minimal 1:1 ratio of  $\text{NH}_2$  radical (or  $\text{NH}_3$ ) to NO, whereby the  $\text{NH}_2$  radical is generated by decomposition of the SNCR chemical and the NO is generated from the gas generant combustion. The reduced content of toxic gases, such as  $\text{NO}_x$  and CO, permits the use of nonazide gas generants in vehicle occupant restraint systems while protecting the occupants of the vehicle from exposure to relatively higher levels of toxic gases.

SNCR technology is well known and commonly used in industrial boilers to decrease the levels of toxic nitrogen oxides. For example, see U.S. Patent No. 4,119,702 to Azuhata et al., herein incorporated by reference. As described therein, nitrogen oxides can be readily reduced so long as the  $\text{NH}_2$  radical is made available as shown in the reaction numbered (1).

Until now, SNCR technology has not been successfully implemented in automotive inflator systems. NO is reduced to  $\text{N}_2$  by the following gas phase reactions:



Because  $\text{NO}_2$  is generated by NO, a reduction in NO necessarily causes an overall  $\text{NO}_x$  reduction within the inflator gas. Thus, for every mol of NO produced by combustion of the gas generant composition, one mol of an  $\text{NH}_2$  group (or radical) will be required to form  $\text{N}_2$  and  $\text{H}_2\text{O}$ . Given equations 1 and 2, it will be apparent to one of ordinary skill that one  $-\text{NH}_2$  radical corresponds to

one mol of  $\text{NH}_3$  or one  $\text{NH}_4^+$  cation. Stated another way, one of ordinary skill will appreciate that for each mol of NO produced upon combustion of the gas generating composition, at least one mol of  $\text{NH}_3$  in an oxygen-rich environment or one mol of  $-\text{NH}_2$  must decompose from the SNCR compound. Thus, elementary chemistry dictates that one  $-\text{NH}_2$  group or one mol of  $\text{NH}_3$  will generally be liberated from a related group or ion in the SNCR compound. For example,  $(\text{NH}_4)_2(\text{SO}_4)$  will theoretically liberate 2 mols of  $-\text{NH}_2$  or 2 mols of  $\text{NH}_3$ , one mol for each  $\text{NH}_4^+$  cation found in the compound.

To obtain  $\text{NH}_2$  in the gas phase at an effective level, it is believed that the SNCR chemical thermally decomposes to generate  $\text{NH}_2$  or  $\text{NH}_3$  (which then subsequently reacts with  $\text{O}_2$  to form  $\text{NH}_2$ ). As shown in equation (1), the minimum  $\text{NH}_2/\text{NO}$  ratio in the gas phase reaction should be 1 mole of  $\text{NH}_2$  for each mole of NO. SNCR technology is most effective at relatively higher initial levels of NO. When ammonia or ammonium salts are used, oxygen is necessary for the formation of  $\text{NH}_2$ , and should be present at levels of 0.1 to 11 volume percent.

The gas temperatures, degree of mixing, and residence time for a given inflator are determined primarily by the gas generant properties and the inflator configuration and operating conditions. One of ordinary skill will appreciate that the reaction kinetics related to reducing the amounts of  $\text{NO}_x$  and CO can be enhanced or inhibited based on these design considerations. Nevertheless, the present invention is believed to be applicable to a wide variety of gas generators employing a wide variety of gas generant compositions. U.S. Patent Nos. 5,628,528, 5,622,380, 5,700,973, 5,727,813, and 5,806,888 (herein incorporated by reference) exemplify, but do not limit, various gas generator/inflator configurations that are deemed useful in the present context.

It will be appreciated that as the inflator configuration and coolant or filtering structure is varied, the effectiveness of the SNCR technology will also vary to greater or lesser effectiveness. Nevertheless, it is believed that the



introduction of an SNCR agent to the gas generant bed of an airbag inflator will reduce the toxic gases regardless of the inflator structure given the general OEM operating requirements for airbag gas generators. Stated another way, the present invention is generically useful in a wide array of state of the art inflators given that all designs must comply with standard OEM requirements.

Thus, a preferred embodiment of the invention may also be expressed as an improvement within a gas generator comprising a pelletized and/or extruded nitrogen-containing nonazide gas generant composition having a fuel and an oxygen-containing oxidizer, wherein the gas generant composition combusts to yield gases comprising  $\text{NO}_x$  gas, the improvement including:

a selective non-catalytic reducing compound selected from the group of ammonia derivatives consisting of ammonium salts, amines, amides, and imides, wherein the reducing compound contains at least one mole of elemental nitrogen per one mole of  $\text{NO}_x$  produced by the gas generant mixture upon combustion, and is discretely interspersed about the gas generating composition in heterogeneous relation thereto.

Variables such as the thermodynamic properties of the generant, the burning rate of the generant, the cooling devices within the inflator, and the operating pressure of the inflator each contribute to the overall operating temperature of the SNCR system. The residence time of the gases in an inflator is dependent on the presence of choked flow and the operating pressure. One skilled in the art will readily realize that cognizance and tailoring of these variables when choosing a gas generant and an inflator will enable the use of a wide variety of gas generant compositions in conjunction with the SNCR system.

The present invention is illustrated by the following examples. In each example, the gas generant consisted of extruded or tableted compositions containing 28.6% 5-aminotetrazole (nitrogen-containing fuel), 57.4% strontium

nitrate (nitrogen-containing oxidizer), 8% bentonite clay, and 6% potassium 5-aminotetrazole, formulated as taught in U.S. Patent No. 5,139,588. U.S. Patent No. 5,727,813 generally describes the inflator(s) used throughout the examples.

5

**EXAMPLE 1**

Two nonazide passenger inflators with the same gas generant and hardware were built. Ammonium carbonate ( $(\text{NH}_4)_2\text{CO}_3$ ) was added directly to the generant bed of one of the inflators as a powder at 1.4 wt% of the generant mass. The inflators were deployed in a 100 ft<sup>3</sup> tank and the gaseous effluents were measured over a 30 minute time period. Carbon monoxide (CO) and ammonia ( $\text{NH}_3$ ) were measured by FTIR while nitrogen (II) oxide (NO), nitrogen (IV) oxide ( $\text{NO}_2$ ), and total nitrogen oxides ( $\text{NO}_x$ ) were measured by Chemiluminescence. The time-weighted averages are reported below in ppm.

10

Inflator	CO	NO	$\text{NO}_2$	$\text{NO}_x$	$\text{NH}_3$
Control	665	85.7	29.6	117.6	14
1.4% $(\text{NH}_4)_2\text{CO}_3$	705	52.8	0.9	53.6	96
Percent of Control	106%	62%	3%	46%	686%

This example illustrates that the addition of this SNCR ammonium salt significantly reduces the levels of toxic nitrogen oxides while leaving the CO essentially unchanged.

20

**EXAMPLE 2**

Two nonazide passenger airbag inflators with the same gas generant and hardware were built and tested as described in Example 1. However, the generant load and the cooling assembly differed from that used in Example 1.  $(\text{NH}_4)_2\text{CO}_3$  was added directly to the generant bed of one of the inflators as a powder at 2.6 wt% of the generant mass. The time-weighted averages are reported below in ppm.

25

Inflator	CO	NO	NO <sub>2</sub>	NO <sub>x</sub>	NH <sub>3</sub>
Control	822	106.1	50.5	162	16
2.6%(NH <sub>4</sub> ) <sub>2</sub> CO <sub>3</sub>	798	82.0	30.7	116	147
Percent of Control	97%	77%	61%	72%	919%

This example demonstrates the effect of inflator design when optimizing SNCR technology in an airbag inflator.

### 5 EXAMPLE 3

Two nonazide passenger airbag inflators with the same gas generant and hardware were built and tested as described in Example 1. However, the generant load and the cooling assembly differed from that of Examples 1 and 2. (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> was added directly to the generant bed of one of the inflators as a powder at 1.2 wt % of the generant mass. The time-weighted averages are reported below in ppm.

Inflator	CO	NO	NO <sub>2</sub>	NO <sub>x</sub>	NH <sub>3</sub>
Control	437	59.6	12.5	73.3	8
1.2% (NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	406	62.2	5.2	67.7	57
Percent of Control	93%	104%	42%	92%	712%

Two unexpected yet beneficial results were observed from these tests. First, the addition of ((NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>) resulted in a reduction of both NO<sub>x</sub> and CO. Secondly, a comparison of the NO<sub>2</sub> evolution in the control and in the SNCR samples indicates a decline over time of the NO<sub>2</sub> species in the SNCR sample and an increase in the NO<sub>2</sub> species in the control sample. For the control inflator, the NO<sub>2</sub> was 9.4 ppm at 3 minutes and 16.4 ppm at 30 minutes. This is normally expected since the NO initially produced by the inflator slowly converts to NO<sub>2</sub> in the presence of O<sub>2</sub>. For the inflator with the SNCR chemical, the NO<sub>2</sub> was 7.8 ppm at 3 minutes and steadily decreased to 5.0 ppm at 30

minutes. This example illustrates the effectiveness of this embodiment in retarding the generation of toxic  $\text{NO}_2$ , despite the presence of increased amounts of relatively nontoxic  $\text{NO}$  and  $\text{O}_2$ .

#### EXAMPLE 4

Four nonazide passenger airbag inflators with the same gas generant and hardware were built and tested as described in Example 1. However, the generant load and the cooling assembly differed from that used in Examples 1, 2, or 3.  $(\text{NH}_4)_2\text{SO}_4$  (decomposes at  $235^\circ\text{C}$ ) and  $\text{H}_2\text{NCO}_2\text{NH}_4$  (sublimes at  $60^\circ\text{C}$ ) were each added directly to the generant bed of one of the inflators as a powder at 2.7 wt % of the generant mass. The time-weighted averages are reported below in ppm.

Inflator	CO	NO	$\text{NO}_2$	$\text{NO}_x$	$\text{NH}_3$
Control	552	82.2	30.2	115.2	10
2.7% $(\text{NH}_4)_2\text{SO}_4$	453	81.5	6.2	66.2	105
2.7% $\text{H}_2\text{NCO}_2\text{NH}_4$	715	79	31	112.9	196

Again, the addition of  $(\text{NH}_4)_2\text{SO}_4$  resulted in a reduction of  $\text{NO}_x$  and CO. Also, the  $\text{NO}_2$  level went from 9.4 ppm at 3 minutes to 5.6 ppm at 30 minutes, verifying the data shown in Example 3.

The above description thus implicitly discloses a method of reducing toxicity in effluent gases of a gas generator, produced by combustion of a nitrogen-containing gas generant composition used to inflate a vehicle occupant restraint system, and includes the step of:

inserting a selective non-catalytic reducing compound proximate to and in heterogeneous relationship to the gas generant composition and within the gas generator of a vehicle occupant restraint system, the selective non-catalytic reducing compound in an amount effective to reduce the concentration of particular toxic gases present in the effluent gases.

5 Stated another way, the method of reducing the nitrogen oxide and/or nitrogen dioxide contained in combustion gases of a gas generator used to inflate an airbag of a vehicle occupant restraint system, wherein the gas generator comprises a nitrogen oxide-producing and/or nitrogen dioxide-producing gas generant composition adapted for use within said gas generator, contains the following steps:

10 (1) interspersing a selective non-catalytic reducing compound proximate to and in heterogeneous relationship with the gas generant composition;

(2) decomposing said selective non-catalytic reducing compound to form gaseous products;

(3) combusting said gas generant composition to form gaseous combustion products; and

20 (4) reacting the gaseous products of the selective non-catalytic reducing compound with the gaseous combustion products of the gas generant composition, thereby reducing the quantity of nitrogen monoxide and/or nitrogen dioxide contained in the gaseous combustion products of the gas generator.

25 It will be appreciated that steps 2-4 are inherent to the operation of any given inflator once the main gas generant is ignited.

While the preferred embodiment of the invention has been disclosed, it should be appreciated that the invention is susceptible of modification without departing from the scope of the following claims.

WE CLAIM:

1. In a gas generator comprising a nitrogen-containing nonazide gas generant composition having a fuel and an oxygen-containing oxidizer, wherein the gas generant is extruded into a desirable shape and upon combustion yields gases comprising NO<sub>x</sub> gas, the improvement comprising:

a selective non-catalytic reducing compound selected from the group consisting of ammonium salts, amines, amides, and imides, wherein the reducing compound contains at least one mole of elemental nitrogen per one mole of NO<sub>x</sub> produced by the gas generating mixture upon combustion, and is discretely interspersed about the gas generating composition in heterogeneous relation thereto.

2. In a gas generator comprising a pyrotechnic gas generating mixture, said pyrotechnic gas generating mixture comprising at least one material of each of the following functional groups of materials – a) a fuel selected from the group of azole compounds consisting of triazole, aminotetrazole, tetrazole, bitetrazole, and metal salts of these compounds; b) an oxygen containing oxidizer compound selected from the group consisting of alkali metal, alkaline earth metal, lanthanide and ammonium nitrates and perchlorates or from the group consisting of alkali metal and alkaline earth metal chlorates and peroxides; and c) a low-temperature slag forming material which is sufficient in amount during combustion to cause the solid combustion particles to coalesce into easily filterable slag or clinkers but not so much as to make a low viscosity liquid, selected from the group consisting of silicon dioxide, boric oxide and vanadium pentoxide or from the group consisting of alkali metal silicates, borates, and carbonates or from the group consisting of naturally occurring clays and talcs, wherein the gas generating mixture is extruded into a

desirable shape and combusts to yield gases comprising  $\text{NO}_x$  gases, the improvement comprising:

5 a selective non-catalytic reducing compound selected from the group consisting of ammonium salts, amines, amides, and imides, wherein the reducing compound contains at least one mole of elemental nitrogen per one mole of  $\text{NO}_x$  produced by the gas generating mixture upon combustion, and is interspersed about the gas generating mixture in  
10 heterogeneous relation thereto.

3. A vehicle occupant restraint system comprising:

an inflatable air bag;

a gas generator;

1 an extruded nitrogen-containing gas generant composition within said gas generator;

a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing  
20 compound is selected from the group consisting of ammonium salts, amides, imides, or amine-containing compounds.

4. A vehicle occupant restraint system of Claim 3 wherein:

25 said ammonium salt is selected from the group consisting of ammonium carbonate  $((\text{NH}_4)_2\text{CO}_3)$ , ammonium sulfate  $((\text{NH}_4)_2\text{SO}_4)$ , ammonium chloride  $(\text{NH}_4\text{Cl})$ , ammonium carbamate  $(\text{H}_2\text{NCO}_2\text{NH}_4)$ , and ammonium fluoride  $(\text{NH}_4\text{F})$ . ;

5. A method of reducing toxicity in effluent gases of a gas generator, the gases produced by combustion of a nitrogen-containing gas generant composition and used to inflate an airbag within a vehicle occupant restraint system, the method comprising the step of:

5 inserting a selective non-catalytic reducing compound within the gas generator of a vehicle occupant restraint system, the selective non-catalytic reducing compound in heterogeneous and proximate relation to the gas generant composition and in an amount effective to reduce the concentration of  
10 particular toxic gases present in the effluent gases.

6. The method of Claim 5 wherein the gas generant composition is nonazide and produces nitrogen oxides upon combustion whereby the nitrogen oxides are then reacted with decomposition products of the selective  
1 non-catalytic reducing compound.

7. A vehicle occupant restraint system comprising an inflatable airbag, a gas generator used to inflate said airbag, a nitrogen-containing nitrogen monoxide-producing and/or nitrogen dioxide-producing gas generant composition  
20 for use within said gas generator, wherein said vehicle occupant restraint system further comprises:

a selective non-catalytic reducing compound proximate to and heterogeneously interspersed about said gas generant composition, wherein said selective non-catalytic reducing compound is useful in  
25 reducing the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition and is selected from the group consisting of ammonium salts, amine compounds, amide compounds, and imide compounds.



8. A vehicle occupant restraint system of Claim 7 wherein:  
said selective non-catalytic reducing compound is selected from the group  
consisting of ammonium carbonate  $((\text{NH}_4)_2\text{CO}_3)$ , ammonium sulfate  
 $((\text{NH}_4)_2\text{SO}_4)$ , ammonium chloride  $(\text{NH}_4\text{Cl})$ , ammonium carbamate  
 $(\text{H}_2\text{NCO}_2\text{NH}_4)$ , and ammonium fluoride  $(\text{NH}_4\text{F})$ .

9. A vehicle occupant restraint system of Claim 7 wherein:  
said selective non-catalytic reducing compound is urea  $(\text{H}_2\text{NCONH}_2)$ .

10. A vehicle occupant restraint system of Claim 7 wherein:  
said selective non-catalytic reducing compound is cyanuric acid  $(\text{HNCO})_3$ .

11. A method of reducing the amount of nitrogen monoxide  
and/or nitrogen dioxide contained in combustion gases of a gas generator used  
to inflate an airbag of a vehicle occupant restraint system, wherein the gas  
generator comprises a nitrogen monoxide-producing and/or nitrogen dioxide-  
producing gas generant composition containing nitrogen, the method comprising  
the steps of:

interspersing a selective non-catalytic reducing compound proximate to  
and in heterogeneous relationship with the gas generant  
composition;

decomposing said selective non-catalytic reducing compound to form  
gaseous products;

combusting said gas generant composition to form gaseous combustion  
products; and

reacting the gaseous products of the selective non-catalytic reducing  
compound with the gaseous combustion products of the gas  
generant composition, thereby reducing the nitrogen monoxide  
and/or nitrogen dioxide contained in the gaseous combustion  
products of the gas generator,

wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amine compounds, amide compounds, and imide compounds.

5

12. The method of claim 11 wherein:

said selective non-catalytic reducing compound is selected from a group consisting of ammonium carbonate  $((\text{NH}_4)_2\text{CO}_3)$ , ammonium sulfate  $((\text{NH}_4)_2\text{SO}_4)$ , ammonium chloride  $(\text{NH}_4\text{Cl})$ , ammonium carbamate  $(\text{H}_2\text{NCO}_2\text{NH}_4)$ , and ammonium fluoride  $(\text{NH}_4\text{F})$ .

**SELECTIVE NON-CATALYTIC REDUCTION (SNCR) OF TOXIC  
GASEOUS EFFLUENTS**

ABSTRACT OF THE DISCLOSURE

5            Selective non-catalytic reducing (SNCR) compounds, independent  
of the gas generant composition, reduce the toxicity of effluent gases produced  
by combustion of nonazide gas generating compositions used to inflate vehicle  
occupant restraint systems. It is believed that reaction of the  $\text{NH}_2$  radical  
(formed from the SNCR compound) with NO in the combustion gas forms  $\text{N}_2$   
10        thereby decreasing the concentration of toxic nitrogen oxides therein.  
Heterogeneous placement of the reducing compound proximate to the gas  
generant bed within a gas generator ensures intimate contact with the  
combustion gases, and yet still provides a noninvasive method of toxic gas  
reduction.

## **Appendix B**

### **Office Action Responses From 8/21/01 – 8/21/03**

IN THE UNITED STATES PATENT  
AND TRADEMARK OFFICE

Group Art Unit 3641  
Examiner Edward A. Miller

SEAN P. BURNS, et al.

RESPONSE TO RESTRICTION AND  
SPECIES ELECTION REQUIREMENTS AND  
PRELIMINARY AMENDMENT

Serial No. 09/638,606

Filed August 15, 2000

For: SELECTIVE NON-CATALYTIC REDUCTION  
(SNCR) OF TOXIC GASEOUS EFFLUENTS  
IN AIRBAG INFLATORS /

August 21, 2001

Assistant Commissioner For Patents  
Washington, D. C. 20231

Sir:

Responsive to the office action mailed on May 21, 2001, having a one-month period of response, please amend as follows:

IN THE CLAIMS

Please cancel claims 1, 2, and 4-12.

Please amend claim 3 as follows:

3. (amended) A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a nitrogen-containing gas generant composition within said gas generator;

I hereby certify that this correspondence is being deposited with the U.S. Postal Service in an envelope with sufficient postage as first class mail addressed to: Assistant Commissioner For Patents, Washington, D.C. 20231, on August 21, 2001.

Name of person mailing: C. Gail Boes Signature: C. Gail Boes Date 8/21/01

a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, or amine-containing compounds.

Please add the following new claims:

13. (new) The vehicle occupant restraint system of claim 3 wherein said gas generant composition is extruded into a desirable shape and upon combustion yields gases comprising  $\text{NO}_x$  gas, and, said reducing compound contains at least one mole of elemental nitrogen per one mole of  $\text{NO}_x$  produced by the gas generant composition upon combustion and is discretely interspersed about the gas generant composition.

14. (new) The vehicle occupant restraint system of claim 3 wherein said gas generant composition comprises at least one material of each of the following functional groups of materials – a) a fuel selected from the group of azole compounds consisting of triazole, aminotetrazole, tetrazole, bitetrazole, and metal salts of these compounds; b) an oxygen containing oxidizer compound selected from the group consisting of alkali metal, alkaline earth metal, lanthanide and ammonium nitrates and perchlorates or from the group consisting of alkali metal and alkaline earth metal chlorates and peroxides; and c) a low-temperature slag forming material which is sufficient in amount during combustion to cause the solid combustion particles to coalesce into easily filterable slag or clinkers but not so much as to make a low viscosity liquid, selected from the group consisting of silicon dioxide, boric oxide and vanadium pentoxide or from the group consisting of alkali metal silicates, borates, and carbonates or from the group consisting of naturally occurring clays and talcs, and, the gas generant composition is extruded into a desirable shape and combusts to yield gases comprising  $\text{NO}_x$  gases, and, the

reducing compound contains at least one mole of elemental nitrogen per one mole of  $\text{NO}_x$  produced by the gas generating mixture upon combustion, and is interspersed about the gas generant composition.

15. (new) The vehicle occupant restraint system of claim 3 wherein said nitrogen-containing gas generant composition produces nitrogen monoxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

16. (new) The vehicle occupant restraint system of claim 13 wherein said nitrogen-containing gas generant composition produces nitrogen monoxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

17. (new) The vehicle occupant restraint system of claim 14 wherein said nitrogen-containing gas generant composition produces nitrogen monoxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

18. (new) A vehicle occupant restraint system of Claim 3 wherein:  
said selective non-catalytic reducing compound is selected from the group

consisting of ammonium carbonate  $((\text{NH}_4)_2\text{CO}_3)$ , ammonium sulfate  $((\text{NH}_4)_2\text{SO}_4)$ , ammonium chloride  $(\text{NH}_4\text{Cl})$ , ammonium carbamate  $(\text{H}_2\text{NCO}_2\text{NH}_4)$ , and ammonium fluoride  $(\text{NH}_4\text{F})$ .

19. (new) A vehicle occupant restraint system of Claim 3 wherein:  
said selective non-catalytic reducing compound is urea  $(\text{H}_2\text{NCONH}_2)$ .
20. (new) A vehicle occupant restraint system of Claim 3 wherein:  
said selective non-catalytic reducing compound is cyanuric acid  $(\text{HNCO})_3$

#### REMARKS

Responsive to the office action mailed on May 21, 2001 (paper no. 4), applicants respond as follows.

Relative to the restriction requirement, applicants elect Group II and cancel Groups I, III, IV, and V with traverse.

The examiner has identified three patentably distinct species of the claimed invention: (A) inventions with ammonium salt SNCR, (B) inventions with amine SNCR, and (C) inventions with amide or imide SNCR. Relative to the species election requirement, applicants identify the species election in the language of the examiner: namely, (A) inventions with ammonium salt SNCR. Thus, applicants understand their election to encompass a vehicle occupant restraint system of Group II containing any gas generant composition as claimed combined with an ammonium salt SNCR agent. Thus, for example only, this might include a vehicle occupant restraint system containing a gas generant composition as claimed in new claim 14 combined with ammonium sulfate. More specifically, the election would encompass for example only, a vehicle occupant restraint system containing a gas generant composition containing 5-aminotetrazole, strontium nitrate, and clay, and, an SNCR agent of ammonium sulfate contained in the gas generant bed as claimed. Applicants request clarification from the examiner if necessary. Applicants therefore understand the species election to read on claims



3 and 13-18.

Antecedent support for the amendments and new claims may be found, for example, as indicated below:

Amended Claim 3

Original Claim 7

New Claim 13

Original Claims 3 and 1

New Claim 14

Original Claims 3 and 2

New Claim 15

Original Claims 3 and 7

New Claim 16

Original Claims 3, 7, and 1

New Claim 17

Original Claims 3, 7, and 2

New Claim 18

Original Claim 8

New Claim 19

Original Claim 9

New Claim 20

Original Claim 10

By this amendment, applicants have attempted to clarify and better define the present invention. Accordingly, the allowance of claims 3 and 13-20, and passage of the subject application to issue are courteously solicited.

Concurrently herewith, applicants petition for a two-month extension for response. Our check in the amount of \$390.00 is included in payment thereof. The Commissioner is authorized to charge any deficiencies or credit any overpayments to Deposit Account No. 04-1311. A duplicate copy of the first page of this transmittal is also enclosed.

Respectfully submitted,

Date

8/21/01

Dinnin & Dunn, P.C.  
Suite 2100  
755 West Big Beaver Road  
Troy, Michigan 48084

By

Laurence C. Begin

Laurence C. Begin  
Reg. No. 42310  
Phone (248) 362-2800  
FAX (248) 362-2864

**MARKED UP CLAIMS AND AMENDMENTS**

3. (amended) A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - [an] a [extruded] nitrogen-containing gas generant composition within said gas generator;
  - a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, or amine-containing compounds.
13. (new) The vehicle occupant restraint system of claim 3 wherein said gas generant composition is extruded into a desirable shape and upon combustion yields gases comprising NO<sub>x</sub> gas, and, said reducing compound contains at least one mole of elemental nitrogen per one mole of NO<sub>x</sub> produced by the gas generant composition upon combustion and is discretely interspersed about the gas generant composition.
14. (new) The vehicle occupant restraint system of claim 3 wherein said gas generant composition comprises at least one material of each of the following functional groups of materials – a) a fuel selected from the group of azole compounds consisting of triazole, aminotetrazole, tetrazole, bitetrazole, and metal salts of these compounds; b) an oxygen containing oxidizer compound selected from the group consisting of alkali metal, alkaline earth metal, lanthanide and ammonium nitrates and perchlorates or from the group consisting of alkali metal and alkaline earth metal chlorates and peroxides; and c) a low-temperature slag forming material which is sufficient in amount during combustion to cause the solid combustion particles to coalesce into easily filterable slag or clinkers but not so much as to make a low viscosity liquid, selected from the group consisting of

silicon dioxide, boric oxide and vanadium pentoxide or from the group consisting of alkali metal silicates, borates, and carbonates or from the group consisting of naturally occurring clays and talcs, and, the gas generant composition is extruded into a desirable shape and combusts to yield gases comprising  $\text{NO}_x$  gases, and, the reducing compound contains at least one mole of elemental nitrogen per one mole of  $\text{NO}_x$  produced by the gas generating mixture upon combustion, and is interspersed about the gas generant composition.

15. (new) The vehicle occupant restraint system of claim 3 wherein said nitrogen-containing gas generant composition produces nitrogen monoxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

16. (new) The vehicle occupant restraint system of claim 13 wherein said nitrogen-containing gas generant composition produces nitrogen monoxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

17. (new) The vehicle occupant restraint system of claim 14 wherein said nitrogen-containing gas generant composition produces nitrogen monoxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant

composition.

18. (new) A vehicle occupant restraint system of Claim 3 wherein:  
said selective non-catalytic reducing compound is selected from the group  
consisting of ammonium carbonate  $((\text{NH}_4)_2\text{CO}_3)$ , ammonium sulfate  
 $((\text{NH}_4)_2\text{SO}_4)$ , ammonium chloride  $(\text{NH}_4\text{Cl})$ , ammonium carbamate  
 $(\text{H}_2\text{NCO}_2\text{NH}_4)$ , and ammonium fluoride  $(\text{NH}_4\text{F})$ .
19. (new) A vehicle occupant restraint system of Claim 3 wherein:  
said selective non-catalytic reducing compound is urea  $(\text{H}_2\text{NCONH}_2)$ .
20. (new) A vehicle occupant restraint system of Claim 3 wherein:  
said selective non-catalytic reducing compound is cyanuric acid  $(\text{HNCO})_3$

IN THE UNITED STATES PATENT  
AND TRADEMARK OFFICE

Group Art Unit 3641  
Examiner Edward A. Miller

SEAN P. BURNS, et al.

AMENDMENT AND REQUEST  
FOR RECONSIDERATION

Serial No. 09/638,606

Filed August 15, 2000

For: SELECTIVE NON-CATALYTIC REDUCTION  
(SNCR) OF TOXIC GASEOUS EFFLUENTS  
IN AIRBAG INFLATORS /

April 26, 2002

Assistant Commissioner For Patents  
Washington, D. C. 20231

Sir:

Responsive to the office action mailed on January 2, 2002, having a three-month period of response, please amend as follows. Applicants also concurrently petition for a one-month extension for the period of response.

IN THE CLAIMS

Please amend the following claim(s):

3. (twice amended) A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a nitrogen-containing gas generant composition within said gas generator;

I hereby certify that this correspondence is being deposited with the U.S. Postal Service in an envelope with sufficient postage as first class mail addressed to: Assistant Commissioner For Patents, Washington, D.C. 20231, on April 26, 2002.

Name of person mailing: C. Gail Boes Signature: C. Gail Boes Date 4/26/02

a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds.

Please add the following new claims:

21. (new) A vehicle occupant restraint system comprising:
  - an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a nitrogen-containing gas generant composition within said gas generator;
  - a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds.
22. (new) The vehicle occupant restraint system of claim 21 wherein said selective non-catalytic reducing compound is ammonium sulfate.
23. (new) A vehicle occupant restraint system comprising:
  - an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a gas generant composition within said gas generator;
  - a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium

salts and amine-containing compounds.

24. (new) The vehicle occupant restraint system of claim 23 wherein the gas generant composition is a nonazide gas generant composition and said selective non-catalytic reducing compound is ammonium sulfate.
25. (new) A vehicle occupant restraint system comprising:
  - an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a gas generant composition within said gas generator;
  - a selective non-catalytic reducing compound proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds.
26. (new) The vehicle occupant restraint system of claim 25 wherein the gas generant composition is a nonazide gas generant composition and the selective non-catalytic reducing compound is ammonium sulfate.
27. (new) A vehicle occupant restraint system comprising:
  - an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a gas generant composition within said gas generator;
  - a selective non-catalytic reducing compound placed proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds.

28. (new) The vehicle occupant restraint system of claim 27 wherein the gas generant composition is a nonazide gas generant composition and the selective non-catalytic reducing compound is ammonium sulfate.
29. (new) A vehicle occupant restraint system comprising:  
an inflatable air bag;  
a gas generator for inflating said air bag;  
a nonazide gas generant composition within said gas generator;  
a selective non-catalytic reducing compound placed proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds.
30. (new) The vehicle occupant restraint system of claim 29 wherein said selective non-catalytic reducing compound is ammonium sulfate.
31. (new) A vehicle occupant restraint system comprising:  
an inflatable air bag;  
a gas generator for inflating said air bag;  
a gas generant composition located within said gas generator; and  
a selective non-catalytic reducing compound placed proximate to and interspersed about said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine compounds.
32. (new) The vehicle occupant restraint system of claim 31 wherein said gas



generant composition is a nonazide composition and said selective non-catalytic reducing compound is ammonium sulfate.

33. (new) The vehicle occupant restraint system of Claim 31 wherein:  
said selective non-catalytic reducing compound is selected from the group consisting of ammonium carbonate  $((\text{NH}_4)_2\text{CO}_3)$ , ammonium sulfate  $((\text{NH}_4)_2\text{SO}_4)$ , ammonium chloride  $(\text{NH}_4\text{Cl})$ , ammonium carbamate  $(\text{H}_2\text{NCO}_2\text{NH}_4)$ , and ammonium fluoride  $(\text{NH}_4\text{F})$ .

#### REMARKS

Responsive to the office action mailed on January 2, 2002, applicants have presented new claims to further state the present invention.

Relative to the restriction requirement, applicants note that claims 3, 13-18, and 21-33 read on the species election of record.

Antecedent support for the new claims may be found throughout the specification.

#### **The Rejections:**

The examiner states that claim 3 is rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Burns et al. WO 98/06682.

Applicants note that Burns et al. is equivalent to the parent application of the present application, the parent application being U.S. Serial Number 08/695,954 filed on August 12, 1996. Applicants have claimed priority to the parent application and assert the same priority to rebut the examiner's rejections based on novelty and/or obviousness.

In essence, applicants maintain that each pending claim has either explicit and/or inherent basis in the parent application as drafted, and is therefore entitled to the earlier filing date as a basis for priority. Notwithstanding the examiner's assertions, applicants have, in the pending claims, maintained the same scope of invention as explicitly or inherently described in the parent application.

Accordingly, applicants respectfully traverse the rejections of claims 3 and 13-18 and request the examiner's reconsideration thereof. For each pending claim has a basis in the parent application, thereby obviating the rejections predicated on WO 98/06682 and nullifying the same as a prior art reference.

By these amendments, applicants have attempted to further state the present invention. Accordingly, the allowance of all pending claims, and passage of the subject application to issue are courteously solicited.

Concurrently herewith, applicants petition for a one-month extension for response. Furthermore, applicants present additional claims that include six additional independent claims, and therefore include payment for four independent claims in excess of three. Our check in the amount of \$446.00 is included in payment thereof. The Commissioner is authorized to charge any deficiencies or credit any overpayments to Deposit Account No. 04-1311. A duplicate copy of the first page of this transmittal is also enclosed.

Respectfully submitted,

Date 4/26/02

Dinnin & Dunn, P.C.  
Suite 2100  
755 West Big Beaver Road  
Troy, Michigan 48084

By Laurence C. Begin

Laurence C. Begin  
Reg. No. 42310  
Phone (248) 362-2800  
FAX (248) 362-2864

**MARKED UP CLAIMS AND AMENDMENTS**

3. (twice amended) A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a nitrogen-containing gas generant composition within said gas generator;
  - a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, [or] and amine-containing compounds.

IN THE UNITED STATES PATENT  
AND TRADEMARK OFFICE

Group Art Unit 3641  
Examiner Edward A. Miller

SEAN P. BURNS, et al.

REQUEST FOR RECONSIDERATION

Serial No. 09/638,606

Filed August 15, 2000

For: SELECTIVE NON-CATALYTIC REDUCTION  
(SNCR) OF TOXIC GASEOUS EFFLUENTS  
IN AIRBAG INFLATORS /

September 23, 2002

Box Nonfee  
Assistant Commissioner For Patents  
Washington, D. C. 20231

Sir:

Responsive to the office action mailed on August 23, 2002 (paper No. 8), having a one-month period of response, applicants appreciate the opportunity to augment the response filed on April 26, 2002:

In accordance with the examiner's comments, applicants have previously stated how the claims avoid the prior art. Namely, the prior art cited, WO 98/06682 does not anticipate the present invention under 35 U.S.C. 102(b) or 103(a) because each of claims 3 and 13-33 have either inherent or explicit basis in the priority application (U.S. application serial no. 08/695,954) filed on August 12, 1996. As such, WO 98/06682 having the same priority date as the present application simply does not qualify as prior art.

Specifically, each claim has at least the following basis in U.S. application serial no. 08/695,954:

Claim 3

Original Claim 7

Claim 13

Original Claims 3 and 1

I hereby certify that this correspondence is being deposited with the U.S. Postal Service in an envelope with sufficient postage as first class mail addressed to: Box Non-Fee Amendment Assistant Commissioner For Patents, Washington, D.C. 20231, on September 23, 2002.

Name of person mailing: C. Gail Boes

Signature: C. Gail Boes

Date 9/23/02

Claim 14	Original Claims 3 and 2, inherent as found in specification, see page 1, lines 25-35; also inherent as known in the art
Claim 15	Original Claims 3 and 7
Claim 16	Original Claims 3, 7, and 1
Claim 17	Original Claims 3, 7, and 2
Claim 18	Original Claim 8
Claim 19	Original Claim 9
Claim 20	Original Claim 10
Claim 21	Original Claim 1
Claim 22	Original Claim 2
Claim 23	Original Claim 1
Claim 24	Original Claims 1 and 2
Claim 25	Original Claim 1
Claim 26	Original Claim 1
Claim 27	Original Claims 1 and 2
Claim 28	Original Claims 1 and 2
Claim 29	Original Claim 1
Claim 30	Original Claim 2
Claim 31	Original Claim 1
Claim 32	Original Claim 2
Claim 33	Original Claim 2

Applicants further appreciate the examiner's comments relative to *In re Lukach* and *In re DeSeversky*. Applicants understand the cases to represent the proposition that mere mentioning of a reference does not affirmatively incorporate that reference within the subject application. Applicants nevertheless believe that the breadth of the present application is at least the breadth of the priority application relied upon and that all claims as given above have a priority basis in the parent application. The examiner alludes to the idea that the present

application is narrower than the priority application. Applicants respectfully traverse this assertion, for as stated above, the application enjoys priority from the priority application not only given the explicit basis given above, but also given the inherent basis by what was known in the art at the time of filing the parent application. Applicants have augmented the parent application to better describe the invention, but still understand the earlier invention to contain the requisite subject matter for priority purposes of the present invention.

Finally, applicants would cite MPEP 2133.01 and *Paperless Accounting v. Bay Area Rapid Transit System* also cited therein. That case stands for the proposition that a CIP may be rejected by its priority document if the claims in the CIP do not have a basis in the priority document or parent application. As stated above, applicants believe the opposite is true in the present application and therefore respectfully traverse the examiner's rejections on that basis.

Applicants have earnestly attempted to respond to the pending office action and would appreciate a call from the examiner should further clarification be desired. Accordingly, applicants respectfully traverse the rejections of claims 3 and 13-33 and request the examiner's reconsideration thereof. For each pending claim has a basis in the parent application, thereby obviating the rejections predicated on WO 98/06682 and nullifying the same as a prior art reference.

Applicants have calculated no additional charge to be due in connection with this paper. The Commissioner is authorized to charge any deficiencies or credit any overpayments to Deposit Account No. 04-1311. A duplicate copy of the first page of this transmittal is also enclosed.

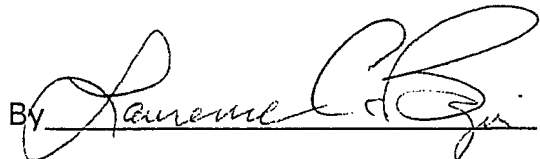
Respectfully submitted,

Date

9/23/02

Dinnin & Dunn, P.C.  
Suite 2100  
755 West Big Beaver Road  
Troy, Michigan 48084

By



Laurence C. Begin  
Reg. No. 42310  
Phone (248) 362-2800  
FAX (248) 362-2864

IN THE UNITED STATES PATENT  
AND TRADEMARK OFFICE

Group Art Unit 3641  
Examiner Edward A. Miller

AMENDMENT AND REQUEST  
FOR RECONSIDERATION

SEAN P. BURNS, et al.

Serial No. 09/638,606

Filed August 15, 2000

For: SELECTIVE NON-CATALYTIC REDUCTION  
(SNCR) OF TOXIC GASEOUS EFFLUENTS  
IN AIRBAG INFLATORS /

August 21, 2003

Commissioner For Patents  
Alexandria, Virginia 22313

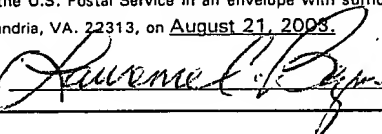
Sir:

Responsive to the office action mailed on April 21, 2003 (paper No. 10), having a three-month period of response, please amend as follows. Concurrently herewith, Applicants petition for a one-month extension of time for response and include the appropriate fee.

I hereby certify that this correspondence is being deposited with the U.S. Postal Service in an envelope with sufficient postage as first class mail addressed to: Commissioner For Patents, P.O. Box 1450 Alexandria, VA. 22313, on August 21, 2003.

Name of person mailing: Laurence C. Begin

Signature



Date

8/21/03

**IN THE CLAIMS**

3. (currently amended) A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a nitrogen-containing gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and
  - a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds, wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

13. (original) The vehicle occupant restraint system of claim 3 wherein said gas generant composition is extruded into a desirable shape and upon combustion yields gases comprising NO<sub>x</sub> gas, and, said reducing compound contains at least one mole of elemental nitrogen per one mole of NO<sub>x</sub> produced by the gas generant composition upon combustion and is discretely interspersed about the gas generant composition.

14. (currently amended) The vehicle occupant restraint system of claim 3 wherein said gas generant composition comprises at least one material of each of the following functional groups of materials – a) a fuel selected from the group of azole compounds consisting of triazole, aminotetrazole, tetrazole, bitetrazole, and metal salts of these compounds; b) an oxygen containing oxidizer compound



selected from the group consisting of alkali metal, alkaline earth metal, lanthanide and ammonium nitrates and perchlorates or from the group consisting of alkali metal and alkaline earth metal chlorates and peroxides; and c) a low-temperature slag forming material which is sufficient in amount during combustion to cause the solid combustion particles to coalesce into easily filterable slag or clinkers but not so much as to make a low viscosity liquid, selected from the group consisting of silicon dioxide, boric oxide and vanadium pentoxide or from the group consisting of alkali metal silicates, borates, and carbonates or from the group consisting of naturally occurring clays and talcs, and, the gas generant composition is extruded into a desirable shape and combusts to yield gases comprising  $\text{NO}_x$  gases, and, the reducing compound contains at least one mole of elemental nitrogen per one mole of  $\text{NO}_x$  produced by the gas generating mixture upon combustion, and is interspersed about the gas generant composition.

15. (currently amended) The vehicle occupant restraint system of claim 3 wherein said nitrogen-containing gas generant composition produces nitrogen monoxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

16. (currently amended) The vehicle occupant restraint system of claim 13 wherein said nitrogen-containing gas generant composition produces nitrogen monoxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

17. (currently amended) The vehicle occupant restraint system of claim 14 wherein said nitrogen-containing gas generant composition produces nitrogen monoxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

18. (original) A vehicle occupant restraint system of Claim 3 wherein:  
said selective non-catalytic reducing compound is selected from the group consisting of ammonium carbonate  $((\text{NH}_4)_2\text{CO}_3)$ , ammonium sulfate  $((\text{NH}_4)_2\text{SO}_4)$ , ammonium chloride  $(\text{NH}_4\text{Cl})$ , ammonium carbamate  $(\text{H}_2\text{NCO}_2\text{NH}_4)$ , and ammonium fluoride  $(\text{NH}_4\text{F})$ .

19. (original, withdrawn from consideration) A vehicle occupant restraint system of Claim 3 wherein:  
said selective non-catalytic reducing compound is urea  $(\text{H}_2\text{NCONH}_2)$ .

20. (original, withdrawn from consideration) A vehicle occupant restraint system of Claim 3 wherein:  
said selective non-catalytic reducing compound is cyanuric acid  $(\text{HNCO})_3$

21. (currently amended) A vehicle occupant restraint system comprising:  
an inflatable air bag;  
a gas generator for inflating said air bag;  
a nitrogen-containing gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and  
a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant

composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds,

wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

22. (previously added) The vehicle occupant restraint system of claim 21 wherein said selective non-catalytic reducing compound is ammonium sulfate.

23. (currently amended) A vehicle occupant restraint system comprising:  
an inflatable air bag;  
a gas generator for inflating said air bag;  
a nitrogen-containing nonazide gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and  
a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds,  
wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

24. (currently amended) The vehicle occupant restraint system of claim 23 wherein ~~the gas generant composition is a nonazide gas generant~~

~~composition~~—and said selective non-catalytic reducing compound is ammonium sulfate.

25. (currently amended) A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and
  - a selective non-catalytic reducing compound proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds,  
wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.
26. (previously added) The vehicle occupant restraint system of claim 25 wherein the gas generant composition is a nonazide gas generant composition and the selective non-catalytic reducing compound is ammonium sulfate.
27. (currently amended) A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and

a selective non-catalytic reducing compound placed proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds

wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

28. (previously added) The vehicle occupant restraint system of claim 27 wherein the gas generant composition is a nonazide gas generant composition and the selective non-catalytic reducing compound is ammonium sulfate.

29. (currently amended) A vehicle occupant restraint system comprising:  
an inflatable air bag;  
a gas generator for inflating said air bag;  
a nonazide gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and  
a selective non-catalytic reducing compound placed proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds,  
wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide and/or nitrogen

dioxide produced upon combustion of said gas generant composition.

30. (previously added) The vehicle occupant restraint system of claim 29 wherein said selective non-catalytic reducing compound is ammonium sulfate.

31. (currently amended) A vehicle occupant restraint system comprising:  
an inflatable air bag;  
a gas generator for inflating said air bag;  
a nitrogen-containing gas generant composition located within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and  
a selective non-catalytic reducing compound placed proximate to and interspersed about said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts ~~and amine compounds~~,  
wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

32. (previously added) The vehicle occupant restraint system of claim 31 wherein said gas generant composition is a nonazide composition and said selective non-catalytic reducing compound is ammonium sulfate.

33. (previously added) The vehicle occupant restraint system of Claim 31 wherein:

said selective non-catalytic reducing compound is selected from the group

consisting of ammonium carbonate  $((\text{NH}_4)_2\text{CO}_3)$ , ammonium sulfate  $((\text{NH}_4)_2\text{SO}_4)$ , ammonium chloride  $(\text{NH}_4\text{Cl})$ , ammonium carbamate  $(\text{H}_2\text{NCO}_2\text{NH}_4)$ , and ammonium fluoride  $(\text{NH}_4\text{F})$ .

REMARKS

In accordance with the examiner's comments, applicants have previously stated how the claims avoid the prior art. Namely, the prior art cited, WO 98/06682 does not anticipate the present invention under 35 U.S.C. 102(b) or 103(a) because each of claims 3 and 13-33 have either inherent or explicit support in the priority application (U.S. application serial no. 08/695,954) filed on August 12, 1996. As such, WO 98/06682 having the same priority date as the present application simply does not qualify as prior art.

Specifically, each claim has at least the following support in U.S. application serial no. 08/695,954:

Claim 3	Equations 1 and 2; page 4 lines 1-22; in the Examples; Inherent in the art.
Claim 13	Equations 1 and 2; page 4 lines 1-22; in the Examples; Inherent in the art; Inherent as indicated on page 1, lines 27-34.
Claim 14-20	Equations 1 and 2; page 4 lines 1-22; in the Examples; Inherent in the art; Inherent as indicated on page 1, lines 27-34.
Claims 21-33	Equations 1 and 2; page 4 lines 1-22; in the Examples; Inherent in the art. Inherent as indicated on page 1, lines 27-34.



Applicants further appreciate the examiner's comments relative to *In re Lukach* and *In re DeSeversky*. Applicants understand the cases to represent the proposition that mere mentioning of a reference does not affirmatively incorporate that reference within the subject application. Applicants nevertheless believe that the breadth of the present application is at least the breadth of the priority application relied upon and that all claims as given above have a priority basis in the parent application. The examiner alludes to the idea that the present application is narrower than the priority application. Applicants respectfully traverse this assertion, for as stated above, the application enjoys priority from the priority application not only given the explicit support given above, but also given the inherent support by what was known in the art at the time of filing the parent application. A Declaration Under 37 C.F.R. 1.132 is included herewith in support thereof. Applicants have augmented the parent application to further describe the invention, but still understand the earlier invention to contain the requisite subject matter for priority purposes of the present invention.

Applicants appreciate the comments of the Examiner relative to MPEP 2133.01. Nevertheless, applicants would still cite MPEP 2133.01 and *Paperless Accounting v. Bay Area Rapid Transit System* also cited therein. That case stands for the proposition that a CIP may be rejected by its priority document if the claims in the CIP do not have support in the priority document or parent application. As stated above, applicants believe the opposite is true in the present application and therefore respectfully traverse the examiner's rejections on that basis.

The examiner is correct that the current specification adds more details, but these details further describe the invention. Applicants have always maintained that the parent application, U.S. Patent Application Serial No. 08/695,954 filed on August 12, 1996 sufficiently enables one of ordinary skill in the art given that its written description complies with 35 U.S.C. 112 first paragraph. Applicants therefore do not concede lack of priority simply by virtue of adding further description. The Declaration Under 37 C.F.R. 1.132 is presented in support of the

notion that one of ordinary skill in the art had been enabled to practice the claimed invention as of August 12, 1996, particularly given that the written description of U.S. Patent Application Serial No. 08/695,954 confirmed that the inventor had possession of the invention as now claimed.

Applicants have earnestly attempted to respond to the pending office action and would appreciate a call from the examiner should further clarification be desired. Accordingly, applicants respectfully traverse the rejections of claims 3 and 13-33 and request the examiner's reconsideration thereof. For each pending claim has support in the parent application, thereby obviating the 102(b) and 103(a) rejections predicated on WO 98/06682 and nullifying the same as a prior art reference. The rejections under 35 U.S.C. 102(e), or in the alternative under 35 U.S.C. 103(a), as obvious over Blomquist '104 are traversed for the same reason; namely, the priority document precedes this reference therefore nullifying Blomquist as a prior art reference. Similarly, the rejections under 35 U.S.C. 102(b), or in the alternative under 35 U.S.C. 103(a) as obvious over MacLaren et al. are also traversed for the priority document precedes this reference therefore nullifying MacLaren as a prior art reference. The examiner's rejections under Poole '588, Highsmith et al. '014, Poole et al. '272, and Hurley et al. have been addressed in prior office actions relative to U.S. Patent Application Serial No. 08/695,954, the discussions of which are herein incorporated by reference. In essence, neither of these references when taken alone or in combination responds to the limitations of the claims as drafted, nor do they recognize the present solution (as claimed) to reducing higher nitrogen oxide concentrations.

The examiner has rejected claims 2, 15, 18, and 21-33 under the judicially created doctrine of obviousness type double patenting as being unpatentable over the claims of U.S. Patents No. 6,306,232 and 6,074,502. Neither of these patents responds to the problem of reducing excessive nitrogen oxides as defined in the present claims, namely heterogeneous or separate SNCR agents dispersed about the gas generant composition. Furthermore, both of these patents have filing dates that post date the filing date of the priority document, thereby

nullifying them as prior art references.

With regard to the examiner's rejection of claims 3, 13-18, and 21-33 under 35 U.S.C. 112 first paragraph, the discussion given above relative to the use of the priority document equally applies to the present specification and is incorporated herein by reference. The examiner's attention is directed to the Declaration Under 37 C.F.R. 1.132 in further support of the notion that the present specification as well as the priority document both enable one of ordinary skill in the art to practice the invention without undue experimentation. The claims have been amended relative to the parameters of the SNCR added, including amounts relative to the amount of nitrogen oxides produced by the respective gas generant compositions.

Finally, Applicants are uncertain for the basis of the examiner's requirement that claims 14 and 17 be cancelled as adding new matter to the specification as originally filed. Claims 14 and 17 have inherent support on page 1, line 30 wherein the composition there claimed is found in U.S. Patent Nos. 5,139,588 and 5,035,757, both incorporated by reference into the present application.

Applicants have calculated \$110.00 for a one-month extension of time for response to be due in connection with this paper. The Commissioner is authorized to charge any deficiencies or credit any overpayments to Deposit Account No. 04-1311. A duplicate copy of the first page of this transmittal is also enclosed.

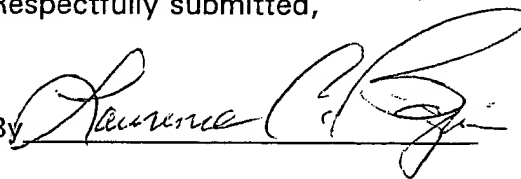
Date

8/21/03

Dinnin & Dunn, P.C.  
2100 Cambridge Court  
Suite 500  
Auburn Hills, Michigan 48326

Respectfully submitted,

By



Laurence C. Begin  
Reg. No. 42310  
Phone (248) 364-2100  
FAX (248) 364-2200

IN THE UNITED STATES PATENT  
AND TRADEMARK OFFICE

Group Art Unit 3641  
Examiner Edward A. Miller

Sean P. Burns, et al.

DECLARATION UNDER  
37 C.F.R. 1.132

Serial No. 09/638,606

Filed August 15, 2000

For: SELECTIVE NON-CATALYTIC REDUCTION  
(SNCR) OF TOXIC GASEOUS EFFLUENTS  
IN AIRBAG INFLATORS \_\_\_\_\_ /

August 21, 2003

Commissioner for Patents  
Alexandria, VA 22313

Sir:

Responsive to the Office Action mailed April 21, 2003 (Paper #10), Applicant respectfully traverses the present rejections. Accordingly, Applicant presents the following declaration filed pursuant to 37 C.F.R. 1.132.

DECLARATION UNDER 37 C.F.R. 1.132

I, Graylon K. Williams, am currently the Chief Chemist for AUTOMOTIVE SYSTEMS LABORATORY, INC., the current assignee of the above-referenced case. I have worked with technologies related to gas generant compositions and propellant technology since 1991. I have been employed by AUTOMOTIVE SYSTEMS LABORATORY, INC. since 1997 where my efforts have been concentrated on development of gas generant compositions within vehicle occupant restraint or protection systems.

I received a Bachelor's of Science in ACS Chemistry from the University of Central Oklahoma in 1989. I next received a Masters of Chemistry from the University of Delaware in 1993. Finally, I completed a Ph.D. degree in Chemistry from the University of Delaware in 1996. I have been involved with gas generant and propellant chemistry since 1991 given that my graduate work in both the Masters and Ph.D. programs emphasized gas generant combustion

I hereby certify that this correspondence is being deposited with the U.S. Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner For Patents, P.O. Box 1450 Alexandria, VA 22313 on August 21, 2003.

Name of person mailing: Laurence C. Begin

Signature: 

Date 8/21/03

and propellant chemistry. Funding sources included Thiokol, the U.S. Navy, the U.S. Air Force, and others. See the Curriculum Vitae included herewith.

With regard to the above-referenced case, I attest to the following:

1. I have reviewed the parent application filed August 12, 1996 having U.S. Application Serial No. 08/695,954. Each comment below is given in the context that the respective subject matter appears in the parent application.
2. With regard to the use of the term "nonazide" and its use in conjunction with "gas generant compositions within vehicle occupant protection systems", it has been well known since prior to August 12, 1996 what gas generant compositions would be included within the generic group of "nonazide gas generant compositions within vehicle occupant protection systems". U.S. Patent Nos. 5,035,757, 5,139,588, 5,514,230, 5,460,668, and 5,531,941 typify and exemplify (but do not limit) known "nonazide gas generant compositions for use within vehicle occupant protection systems" as of August 12, 1996. I have reviewed the state of the technology prior to August 12, 1996 and conclude that one of ordinary skill in the gas generant art *at that time* would be well advised as to the meaning of "nonazide", and also as to what nonazide gas generant compositions would be contemplated and known for their utility within a vehicle occupant protection system.
3. I have also reviewed the parent application and the art with regard to the abbreviation or term NO<sub>x</sub>. I conclude that one of ordinary skill in the gas generant art as of August 12, 1996 would recognize that term to include nitrogen oxides that are produced upon combustion of "nitrogen-containing gas generant compositions". I further conclude one of ordinary skill in the art would have recognized that based on the expected and confirmed chemistry during combustion of these compositions, the nitrogen oxides that would be produced include but are not limited to nitrogen oxide and nitrogen dioxide. Furthermore, one of ordinary skill in the art would have understood that the nonazide gas generant compositions characterized and claimed in the parent application would necessarily contain nitrogen given that the absence of nitrogen would

preclude  $\text{NO}_x$  production thereby obviating the need of the SNCR agent. In essence, during gas generant combustion no  $\text{NO}_x$  production would occur due to atmospheric nitrogen, for example. See page 2, lines 5-11 and page 4, lines 19-30 for example, in the parent application.

4. I have also reviewed the parent application and the art with regard to the radical or chemical intermediate  $\text{NH}_2$ . I conclude that one of ordinary skill in the gas generant art as of August 12, 1996 would have recognized and understood that  $\text{NH}_2$  is produced upon decomposition of the selective non-catalytic reducing agent during the combustion reaction of the nitrogen-containing nonazide gas generant composition. One of ordinary skill in the art would also understand that although the  $\text{NH}_2$  radical exists in the gas phase when a SNCR agent is employed, it would ultimately react with  $\text{NO}_x$  (e.g.  $\text{NO}$  and/or  $\text{NO}_2$ ) as given in equations 1 and 2, when a nitrogen-containing nonazide gas generant composition is also employed in the vehicle occupant protection system. Therefore, as best understood at the time of filing of the parent application, one of ordinary skill would understand that  $\text{NH}_2$  is produced as a radical upon decomposition of the SNCR agent and then reacts with the  $\text{NO}_x$  in the gas phase to produce nitrogen and water as ultimate combustion products.
5. I have also reviewed the parent application with regard to the chemical equations therein. As readily understood by one of ordinary skill in the art, I conclude that the chemical reactions combined with the text indicate that any nitrogen-containing gas generant composition suitable for use within a vehicle occupant protection system may be employed provided that  $\text{NO}_x$  is produced upon combustion of the gas generant. Additionally, one of ordinary skill in the art would readily understand that upon combustion of the gas generant composition, one mol of  $\text{NO}_x$  would be reacted with one mol of  $\text{NH}_2$  or one mol of  $\text{NH}_3$  depending on the equilibrium conditions at any given moment of the combustion reaction. See chemical equations numbered 1 and 2.
6. Based on comment "5" directly above, one of ordinary skill in the art would have understood as of August 12, 1996 that given any gas generant composition that is known to produce a certain amount of  $\text{NO}_x$ , for every mol of  $\text{NO}_x$  produced, at least one mol of  $\text{NH}_2$  or  $\text{NH}_3$  would be

necessary to reduce the  $\text{NO}_x$ . See equations numbered 1 and 2 and also see Example 2.

7. Relative to comments "5" and "6" directly above, when marketing a gas generant composition for use within a vehicle occupant protection system, customer requirements mandate quantification of the various gaseous species produced from combustion of any given gas generant composition, particularly within vehicle occupant protection systems. These requirements predate August 12, 1996. Furthermore, the limits on any given combustion product or species would be defined by the customer thereby indicating what instances for example, would require reduction of  $\text{NO}_x$ . Accordingly, one of ordinary skill in the art would readily know what species were produced from any given gas generant composition, and in what amounts, prior to determining whether or not to add a SNCR agent in the molar amounts defined in reactions 1 and/or 2.
8. Based on the above, it is my opinion that one of ordinary skill in the art upon reading the parent application would readily understand when to practice the invention defined in the parent application. Stated another way, when advised of the amounts of  $\text{NO}_x$  as predetermined by customer requirements, one of ordinary skill in the art would know what amount of SNCR agent to apply in heterogeneous relation to the gas generant composition, thereby reducing the amount of nitrogen oxides produced upon combustion of the gas generant composition. Accordingly, when employing a nitrogen-containing gas generant composition, one of ordinary skill in the art (in possession of laboratory data mandated by customer requirements) would know when application of a SNCR agent would be required. Excessive or undue experimentation would not be required because criteria necessary to evaluate the need of SNCR technology would already be developed. In essence, only review of available data would be necessary. Accordingly, as of August 12, 1996 the applicants of the above-referenced application sufficiently enabled one of ordinary skill in the art to make, use, and practice the invention particularly in view of: the examples and the chemical equations in the specification, the related art, the state of the art, and what was known to one of ordinary skill in the art at the time.

9. I have reviewed the parent application with regard to the difficulty of reducing NO<sub>x</sub> concentration in gas generator effluent gases. I conclude that one of ordinary skill in the art would readily agree that various factors in the design of the vehicle occupant protection system, such as inflator design, gas generant composition, and/or temperature regime throughout the inflator, (e.g. see the Examples) would affect the amount of NO<sub>x</sub> or other species produced. Nevertheless, the Examples indicate that regardless of these factors, NO<sub>x</sub> reduction is still accomplished by addition of an SNCR agent.
10. It should be emphasized that a certain amount of experimentation is required to address the customer requirements given above. Accordingly, any present or future gas generant compositions requiring the use of the SNCR technology would be readily apparent without the need for additional or undue experimentation.
11. I have reviewed the parent application with regard to the term "heterogeneous" as applied to the spatial relationship between the gas generant composition and the selective non-catalytic reducing agent. The ordinary meaning of the term is applicable, that is, the gas generant composition and the SNCR agent are separate compositions existing separate from each other. The term "composition" is also revealing in that it is defined by Webster to mean, "a product of mixing or combining various elements or ingredients". Accordingly, two heterogeneous compositions may also be stated to be two heterogeneous mixtures or two heterogeneous combinations. "Heterogeneous" is defined to mean, "1. different in kind; unlike; incongruous; 2. composed of parts of different kinds; having widely dissimilar elements or constituents; not homogeneous." "Homogeneous" is defined to mean, "1. of the same or a similar kind or nature; 2. of uniform structure or composition throughout."
12. It follows then that when the term "heterogeneous" is applied to the spatial relationship between the gas generant composition and the SNCR agent, it cannot be construed to mean a uniform mixture of a granulated oxidizer (e.g. potassium nitrate) and a granulated ammonium salt. When formulating a gas generant composition for a vehicle occupant protection



system, it is known and accepted that the gas generant composition must be of uniform structure and composition throughout (e.g. **homogeneous**). Therefore, if for the sake of argument potassium nitrate is accepted as a viable gas generant composition within a vehicle occupant protection system, heterogeneous distribution of the SNCR agent throughout the potassium nitrate granules would constitute a practice of the present invention; homogeneous distribution would form a homogeneous composition between potassium nitrate and the SNCR agent, not two heterogeneous compositions as required in the present invention.

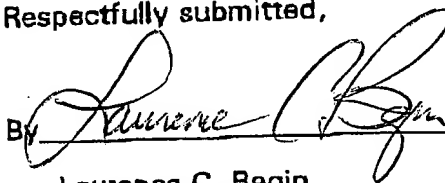
13. As would have been known to one of ordinary skill in the art as of August 12, 1996, a gas generant composition in a vehicle occupant protection system includes at least a fuel and an oxidizer for a complete system. Potassium nitrate is an oxidizer and therefore represents only a portion of the gas generant composition. A gas generant composition would not only contain the oxidizer, but it would also contain a fuel to be a complete system. As such, a gas generant composition for use within a vehicle occupant protection system is defined by all of its constituents, not by one of its constituents such as the oxidizer.
14. In sum, after review of the parent application I conclude that one of ordinary skill in the art, in view of the prior art and in view of industry practice, would realize and understand how to make, use, and practice the invention as described in the parent application. Stated another way, one of ordinary skill in the art would know what nitrogen-containing gas generant compositions would be found within the scope of the invention characterized in the parent application and would also know at what point the SNCR technology described would be necessary. Additionally, one of ordinary skill in the art would be able to determine the amounts of SNCR agent required to reduce the nitrogen oxides given the laboratory data available due to customer requirements and given the equations numbered 1 and 2 as defined in the parent application.

Further declarant sayeth not.



Graylon K. Williams 21 AUG 03  
Chief Chemist  
Automotive Systems Laboratory, Inc.

Respectfully submitted,

By 

Laurence C. Begin  
Reg. No. 42,310  
Phone: 248-364-2100  
Fax: 248-364-2200

Date 8/21/03

Dinnin & Dunn, P.C.  
2701 Cambridge Court, Suite 500  
Auburn Hills, MI 48326

## *Curriculum Vitae of Graylon K. Williams*

"Pyrotechnic Actuator," Blackburn, J.; Williams, G. K.; Burns, S. P.  
U. S. Patent 6,568,184, 2003.

"High Gas Yield Non-Azide Gas Generants," Khandhadia, P. S.; Burns, S. P.;  
Williams, G. K. U. S. Patent 6,210,505, 2001.

"Thermal Decomposition of Energetic Materials 72. Unusual Behavior of  
Substituted Furazan Compounds upon Flash Pyrolysis," Williams, G. K.;  
Brill, T. B. Combust. Flame, 1998, 114, 569.

"Thermal Decomposition of Energetic Materials 70. Kinetics of Organic Peroxide  
Decomposition Derived from the Filament Control Voltage of T-Jump/FTIR  
Spectroscopy," Williams, G. K.; Brill, T. B. Appl. Spectrosc., 1997, 51, 423.

"Toward Quantitative Thermodynamics and Kinetics of Pyrolysis of Bulk  
Materials at High Temperature and Pressure," Williams, G. K.; Brill, T. B.  
Mat. Res. Soc. Symp. Proc., 1996, 418, 163.

"Thermal Decomposition of Energetic Materials 68. Decomposition and  
Sublimation Kinetics of NTO and Evaluation of Prior Kinetic Data,"  
Williams, G. K.; Brill, T. B. J. Phys. Chem., 1995, 99, 12536.

"Thermal Decomposition of Energetic Materials 67. Hydrazinium Nitroformate (HNF)  
Rates and Pathways Under Combustion-like Conditions," Williams, G. K.;  
Brill, T. B. Combust. Flame, 1995, 102, 418.

"Surface Chemistry of Burning Explosives and Propellants," Brill, T. B.; Arisawa, H.;  
Brush, P. J.; Gongwer, P. E.; Williams, G. K. J. Phys. Chem., 1995, 99, 1384.

"Thermal Decomposition of Energetic Materials 66. Kinetic Compensation Effects in  
HMX, RDX, and NTO," Brill, T. B.; Gongwer, P. E.; Williams, G. K.  
J. Phys. Chem., 1994, 98, 12242.

"Thermal Decomposition of Energetic Materials 65. Conversion of Insensitive  
Explosives (NTO, ANTA) and Related Compounds to Polymeric Melon-Like Cyclic  
Azine Burn-rate Suppressants," Williams, G. K.; Palopoli, S. F.;  
Brill, T. B. Combust. Flame, 1994, 98, 197.

"Kinetics and Pathways of Hydrazinium Nitroformate (HNF) Decomposition Under  
Combustion-like Conditions," Williams, G. K.; Brill, T. B. *Gordon Research  
Conference*, New Hampton, NH, June 1994.

"Synthesis, Characterization, and Thermolysis of New Energetic Metal Complexes,"  
*Thiokol University IR & D Review Conference*, Ogden, UT, July 1992.

***EDUCATION:***

**Ph.D. Inorganic Chemistry** University of Delaware, October 1996. Advisor: Dr. Thomas B. Brill. Dissertation Title: "Kinetic and Mechanistic Decomposition Studies on Advanced Energetic Materials."

**M.S. Chemistry** University of Delaware, May 1993. Advisor: Dr. Thomas B. Brill. Thesis Title: "Synthesis, Characterization, and Thermolysis of Triazole Metal Complexes."

**B.S. Chemistry (ACS)** University of Central Oklahoma, December 1989.

## **Appendix C**

### **Amendment of 8/4/04 and Expert Declaration of Dr. Graylon K. Williams**

Serial No. 09/638,606

Atty Docket No. GIO-007-US  
5702-00007

IN THE UNITED STATES PATENT  
AND TRADEMARK OFFICE

Group Art Unit 3641  
Examiner Edward A. Miller

SEAN P. BURNS, et al.

Serial No. 09/638,606

Filed August 15, 2000

For: SELECTIVE NON-CATALYTIC REDUCTION  
(SNCR) OF TOXIC GASEOUS EFFLUENTS  
IN AIRBAG INFLATORS /

**AMENDMENT AND REQUEST  
FOR RECONSIDERATION;  
RESPONSE TO NOTICE OF  
NON-COMPLIANT AMENDMENT**

August 4, 2004

Commissioner For Patents  
Alexandria, Virginia 22313

Sir:

Applicants again present the response to the office action mailed on April 21, 2003 (paper No. 10), in its entirety. This includes the Declaration Under 37 C.F.R. 1.132 described and referenced on pages 10 and 13 herein, and herein incorporated by reference. In accordance with the examiner's remarks in the advisory action mailed on July 7, 2004, Applicants include a complete listing of all the claims and the respective status thereof, and also take this opportunity to correct other informalities.

I hereby certify that this correspondence is being deposited with the U.S. Postal Service in an envelope with sufficient postage as first class mail addressed to: Commissioner For Patents, P.O. Box 1450 Alexandria, VA. 22313, on August 4, 2004.

Name of person mailing: Laurence C. Begin

Signature: 1 

Date 8/4/04

**IN THE CLAIMS**

1. (cancelled)

2. (cancelled)

3. (currently amended) A vehicle occupant restraint system comprising:  
an inflatable air bag;  
a gas generator for inflating said air bag;  
a nitrogen-containing gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and  
a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds,  
wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

4. (cancelled)

5. (cancelled)

6. (cancelled)

7. (cancelled)

8. (cancelled)

9. (cancelled)

10. (cancelled)

11. (cancelled)

12. (cancelled)

13. (previously presented) The vehicle occupant restraint system of claim 3

wherein said gas generant composition is extruded into a desirable shape and upon combustion yields gases comprising NO<sub>x</sub> gas, and, said reducing compound contains at least one mole of elemental nitrogen per one mole of NO<sub>x</sub> produced by the gas generant composition upon combustion and is discretely interspersed about the gas generant composition.

14. (previously presented) The vehicle occupant restraint system of claim 3 wherein said gas generant composition comprises at least one material of each of the following functional groups of materials – a) a fuel selected from the group of azole compounds consisting of triazole, aminotetrazole, tetrazole, bitetrazole, and metal salts of these compounds; b) an oxygen containing oxidizer compound selected from the group consisting of alkali metal, alkaline earth metal, lanthanide and ammonium nitrates and perchlorates or from the group consisting of alkali metal and alkaline earth metal chlorates and peroxides; and c) a low-temperature slag forming material which is sufficient in amount during combustion to cause the solid combustion particles to coalesce into easily filterable slag or clinkers but not so much as to make a low viscosity liquid, selected from the group consisting of silicon dioxide, boric oxide and vanadium pentoxide or from the group consisting of alkali metal silicates, borates, and carbonates or from the group consisting of naturally occurring clays and talcs, and, the gas generant composition is extruded into a desirable shape and combusts to yield gases comprising NO<sub>x</sub> gases, and, the reducing compound contains at least one mole of elemental nitrogen per one mole of NO<sub>x</sub> produced by the gas generating mixture upon combustion, and is interspersed about the gas generant composition.

15. (currently amended) The vehicle occupant restraint system of claim 3 wherein said nitrogen-containing gas generant composition produces nitrogen ~~monoxide~~ oxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing



compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

16. (currently amended) The vehicle occupant restraint system of claim 13 wherein said nitrogen-containing gas generant composition produces nitrogen ~~monoxide~~ oxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

17. (currently amended) The vehicle occupant restraint system of claim 14 wherein said nitrogen-containing gas generant composition produces nitrogen ~~monoxide~~ oxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

18. (previously presented) A vehicle occupant restraint system of Claim 3 wherein:

said selective non-catalytic reducing compound is selected from the group consisting of ammonium carbonate  $((\text{NH}_4)_2\text{CO}_3)$ , ammonium sulfate  $((\text{NH}_4)_2\text{SO}_4)$ , ammonium chloride  $(\text{NH}_4\text{Cl})$ , ammonium carbamate  $(\text{H}_2\text{NCO}_2\text{NH}_4)$ , and ammonium fluoride  $(\text{NH}_4\text{F})$ .

19. (withdrawn) A vehicle occupant restraint system of Claim 3 wherein:  
said selective non-catalytic reducing compound is urea  $(\text{H}_2\text{NCONH}_2)$ .

20. (withdrawn) A vehicle occupant restraint system of Claim 3 wherein:

said selective non-catalytic reducing compound is cyanuric acid (HNCO)<sub>3</sub>)

21. (currently amended) A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a nitrogen-containing gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and
  - a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds,
- wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.
22. (previously presented) The vehicle occupant restraint system of claim 21 wherein said selective non-catalytic reducing compound is ammonium sulfate.
23. (currently amended) A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a nitrogen-containing nonazide gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and
  - a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant

composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds,

wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

24. (currently amended) The vehicle occupant restraint system of claim 23 wherein ~~the gas generant composition is a nonazide gas generant composition and~~ said selective non-catalytic reducing compound is ammonium sulfate.

25. (currently amended) A vehicle occupant restraint system comprising:

an inflatable air bag;

a gas generator for inflating said air bag;

a gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and

a selective non-catalytic reducing compound proximate to, separate from, and interspersed about the ~~gas generant~~ composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds,

wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

26. (previously presented) The vehicle occupant restraint system of claim 25

wherein the gas generant composition is a nonazide gas generant composition and the selective non-catalytic reducing compound is ammonium sulfate.

27. (currently amended) A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and
  - a selective non-catalytic reducing compound placed proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds
- wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.
28. (previously presented) The vehicle occupant restraint system of claim 27 wherein the gas generant composition is a nonazide gas generant composition and the selective non-catalytic reducing compound is ammonium sulfate.
29. (currently amended) A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a nonazide gas generant composition within said gas generator that

forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and

a selective non-catalytic reducing compound placed proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds,

wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide and/or nitrogen dioxide produced upon combustion of said gas generant composition.

30. (previously presented) The vehicle occupant restraint system of claim 29 wherein said selective non-catalytic reducing compound is ammonium sulfate.

31. (currently amended) A vehicle occupant restraint system comprising:

an inflatable air bag;

a gas generator for inflating said air bag;

a nitrogen-containing gas generant composition located within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and

a selective non-catalytic reducing compound placed proximate to and interspersed about said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine compounds,

wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen

dioxide produced upon combustion of said gas generant composition.

32. (previously presented) The vehicle occupant restraint system of claim 31 wherein said gas generant composition is a nonazide composition and said selective non-catalytic reducing compound is ammonium sulfate.

33. (previously presented) The vehicle occupant restraint system of Claim 31 wherein:

said selective non-catalytic reducing compound is selected from the group consisting of ammonium carbonate  $((\text{NH}_4)_2\text{CO}_3)$ , ammonium sulfate  $((\text{NH}_4)_2\text{SO}_4)$ , ammonium chloride  $(\text{NH}_4\text{Cl})$ , ammonium carbamate  $(\text{H}_2\text{NCO}_2\text{NH}_4)$ , and ammonium fluoride  $(\text{NH}_4\text{F})$ .

REMARKS

In accordance with the examiner's comments, applicants have previously stated how the claims avoid the prior art. Namely, the prior art cited, WO 98/06682 does not anticipate the present invention under 35 U.S.C. 102(b) or 103(a) because each of claims 3 and 13-33 have either inherent or explicit support in the priority application (U.S. application serial no. 08/695,954) filed on August 12, 1996. As such, WO 98/06682 having the same priority date as the present application simply does not qualify as prior art.

Specifically, each claim has at least the following support in U.S. application serial no. 08/695,954:

Claim 3	Equations 1 and 2; page 4 lines 1-22; in the Examples; Inherent in the art.
---------	---

Claim 13	Equations 1 and 2; page 4 lines 1-22; in the Examples; Inherent in the art; Inherent as indicated on page 1, lines 27-34.
----------	---

Claim 14-18	Equations 1 and 2; page 4 lines 1-22; in the Examples; Inherent in the art; Inherent as indicated on page 1, lines 27-34.
-------------	---

Claims 21-33	Equations 1 and 2; page 4 lines 1-22; in the Examples; Inherent in the art. Inherent as indicated on page 1, lines 27-34.
--------------	---

Applicants further appreciate the examiner's comments relative to *In re Lukach* and *In re DeSeversky*. Applicants understand the cases to represent the proposition that mere mentioning of a reference does not affirmatively incorporate that reference within the subject application. Applicants nevertheless believe that the breadth of the present application is at least the breadth of the priority application relied upon and that all claims as given above have a priority basis in the parent application. The examiner alludes to the idea that the present application is narrower than the priority application. Applicants respectfully traverse this assertion, for as stated above, the application enjoys priority from the priority application not only given the explicit support given above, but also given the inherent support by what was known in the art at the time of filing the parent application. A Declaration Under 37 C.F.R. 1.132 is included herewith in support thereof. Applicants have augmented the parent application to further describe the invention, but still understand the earlier invention to contain the requisite subject matter for priority purposes of the present invention.

Applicants appreciate the comments of the Examiner relative to MPEP 2133.01. Nevertheless, applicants would still cite MPEP 2133.01 and *Paperless Accounting v. Bay Area Rapid Transit System* also cited therein. That case stands for the proposition that a CIP may be rejected by its priority document if the claims in the CIP do not have support in the priority document or parent application. As stated above, applicants believe the opposite is true in the present application and therefore respectfully traverse the examiner's rejections on that basis.

The examiner is correct that the current specification adds more details, but these details further describe the invention. Applicants have always maintained that the parent application, U.S. Patent Application Serial No. 08/695,954 filed on August 12, 1996 sufficiently enables one of ordinary skill in the art given that its written description complies with 35 U.S.C. 112 first paragraph. Applicants therefore do not concede lack of priority simply by virtue of adding further description. The Declaration Under 37 C.F.R. 1.132 is presented in support of the



notion that one of ordinary skill in the art had been enabled to practice the claimed invention as of August 12, 1996, particularly given that the written description of U.S. Patent Application Serial No. 08/695,954 confirmed that the inventor had possession of the invention as now claimed.

Applicants have earnestly attempted to respond to the pending office action and would appreciate a call from the examiner should further clarification be desired. Accordingly, applicants respectfully traverse the rejections of claims 3 and 13-33 and request the examiner's reconsideration thereof. For each pending claim has support in the parent application, thereby obviating the 102(b) and 103(a) rejections predicated on WO 98/06682 and nullifying the same as a prior art reference. The rejections under 35 U.S.C. 102(e), or in the alternative under 35 U.S.C. 103(a), as obvious over Blomquist '104 are traversed for the same reason; namely, the priority document precedes this reference therefore nullifying Blomquist as a prior art reference. Similarly, the rejections under 35 U.S.C. 102(b), or in the alternative under 35 U.S.C. 103(a) as obvious over MacLaren et al. are also traversed for the priority document precedes this reference therefore nullifying MacLaren as a prior art reference. The examiner's rejections under Poole '588, Highsmith et al. '014, Poole et al. '272, and Hurley et al. have been addressed in prior office actions relative to U.S. Patent Application Serial No. 08/695,954, the discussions of which are herein incorporated by reference. In essence, neither of these references when taken alone or in combination responds to the limitations of the claims as drafted, nor do they recognize the present solution (as claimed) to reducing higher nitrogen oxide concentrations.

The examiner has rejected claims 2, 15, 18, and 21-33 under the judicially created doctrine of obviousness type double patenting as being unpatentable over the claims of U.S. Patents No. 6,306,232 and 6,074,502. Neither of these patents responds to the problem of reducing excessive nitrogen oxides as defined in the present claims, namely heterogeneous or separate SNCR agents dispersed about the gas generant composition. Furthermore, both of these patents have filing dates that post date the filing date of the priority document, thereby

nullifying them as prior art references.

With regard to the examiner's rejection of claims 3, 13-18, and 21-33 under 35 U.S.C. 112 first paragraph, the discussion given above relative to the use of the priority document equally applies to the present specification and is incorporated herein by reference. The examiner's attention is directed to the Declaration Under 37 C.F.R. 1.132 in further support of the notion that the present specification as well as the priority document both enable one of ordinary skill in the art to practice the invention without undue experimentation. The claims have been amended relative to the parameters of the SNCR added, including amounts relative to the amount of nitrogen oxides produced by the respective gas generant compositions.

Finally, Applicants are uncertain for the basis of the examiner's requirement that claims 14 and 17 be cancelled as adding new matter to the specification as originally filed. Claims 14 and 17 have inherent support on page 1, line 30 wherein the composition there claimed is found in U.S. Patent Nos. 5,139,588 and 5,035,757, both incorporated by reference into the present application.

Applicants have not calculated an additional fee to be due in connection with this paper as the one-month period of response has not expired. If the Applicants can be of any further assistance, the examiner is invited to contact the undersigned at the number given below. The undersigned takes this opportunity to point out the change of address as given below and also, as filed in the Correspondence Change of Address on May 25, 2004.

Date

8/4/04

L.C. Begin & Associates, PLLC  
510 Highland Avenue  
PMB 403  
Milford, Michigan 48381-1586

Respectfully submitted,

By Laurence C. Begin

Laurence C. Begin  
Reg. No. 42310  
Phone (248) 889-5875  
FAX (248) 887-7664

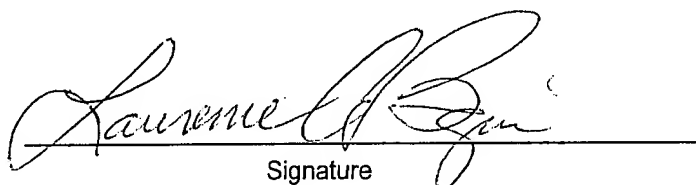
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

**Certificate of Mailing under 37 CFR 1.8**

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to:

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

on AUGUST 4, 2004  
Date



Signature

LAURENCE C. BEGIN

Typed or printed name of person signing Certificate

Note: Each paper must have its own certificate of mailing, or this certificate must identify each submitted paper.

**COPY OF DECLARATION UNDER 37 C.F.R. 1.132  
SUBMITTED AUGUST 21, 2003**

This collection of information is required by 37 CFR 1.8. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.8 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

IN THE UNITED STATES PATENT  
AND TRADEMARK OFFICE

Group Art Unit 3641  
Examiner Edward A. Miller

Sean P. Burns, et al.

DECLARATION UNDER  
37 C.F.R. 1.132

Serial No. 09/638,606

Filed August 15, 2000

For: SELECTIVE NON-CATALYTIC REDUCTION  
(SNCR) OF TOXIC GASEOUS EFFLUENTS  
IN AIRBAG INFLATORS /

August 21, 2003

Commissioner for Patents  
Alexandria, VA 22313

Sir:

Responsive to the Office Action mailed April 21, 2003 (Paper #10), Applicant respectfully traverses the present rejections. Accordingly, Applicant presents the following declaration filed pursuant to 37 C.F.R. 1.132.

DECLARATION UNDER 37 C.F.R. 1.132

I, Graylon K. Williams, am currently the Chief Chemist for AUTOMOTIVE SYSTEMS LABORATORY, INC., the current assignee of the above-referenced case. I have worked with technologies related to gas generant compositions and propellant technology since 1991. I have been employed by AUTOMOTIVE SYSTEMS LABORATORY, INC. since 1997 where my efforts have been concentrated on development of gas generant compositions within vehicle occupant restraint or protection systems.

I received a Bachelor's of Science in ACS Chemistry from the University of Central Oklahoma in 1989. I next received a Masters of Chemistry from the University of Delaware in 1993. Finally, I completed a Ph.D. degree in Chemistry from the University of Delaware in 1996. I have been involved with gas generant and propellant chemistry since 1991 given that my graduate work in both the Masters and Ph.D. programs emphasized gas generant combustion

I hereby certify that this correspondence is being deposited with the U.S. Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner For Patents, P.O. Box 1450 Alexandria, VA 22313 on August 21, 2002.

Name of person mailing: Laurence C. Begin

Signature: 

Date

8/21/03

and propellant chemistry. Funding sources included Thiokol, the U.S. Navy, the U.S. Air Force, and others. See the Curriculum Vitae included herewith.

With regard to the above-referenced case, I attest to the following:

1. I have reviewed the parent application filed August 12, 1996 having U.S. Application Serial No. 08/695,954. Each comment below is given in the context that the respective subject matter appears in the parent application.
2. With regard to the use of the term "nonazide" and its use in conjunction with "gas generant compositions within vehicle occupant protection systems", it has been well known since prior to August 12, 1996 what gas generant compositions would be included within the generic group of "nonazide gas generant compositions within vehicle occupant protection systems". U.S. Patent Nos. 5,035,757, 5,139,588, 5,514,230, 5,460,668, and 5,531,941 typify and exemplify (but do not limit) known "nonazide gas generant compositions for use within vehicle occupant protection systems" as of August 12, 1996. I have reviewed the state of the technology prior to August 12, 1996 and conclude that one of ordinary skill in the gas generant art *at that time* would be well advised as to the meaning of "nonazide", and also as to what nonazide gas generant compositions would be contemplated and known for their utility within a vehicle occupant protection system.
3. I have also reviewed the parent application and the art with regard to the abbreviation or term NO<sub>x</sub>. I conclude that one of ordinary skill in the gas generant art as of August 12, 1996 would recognize that term to include nitrogen oxides that are produced upon combustion of "nitrogen-containing gas generant compositions". I further conclude one of ordinary skill in the art would have recognized that based on the expected and confirmed chemistry during combustion of these compositions, the nitrogen oxides that would be produced include but are not limited to nitrogen oxide and nitrogen dioxide. Furthermore, one of ordinary skill in the art would have understood that the nonazide gas generant compositions characterized and claimed in the parent application would necessarily contain nitrogen given that the absence of nitrogen would

preclude  $\text{NO}_x$  production thereby obviating the need of the SNCR agent. In essence, during gas generant combustion no  $\text{NO}_x$  production would occur due to atmospheric nitrogen, for example. See page 2, lines 5-11 and page 4, lines 19-30 for example, in the parent application.

4. I have also reviewed the parent application and the art with regard to the radical or chemical intermediate  $\text{NH}_2$ . I conclude that one of ordinary skill in the gas generant art as of August 12, 1996 would have recognized and understood that  $\text{NH}_2$  is produced upon decomposition of the selective non-catalytic reducing agent during the combustion reaction of the nitrogen-containing nonazide gas generant composition. One of ordinary skill in the art would also understand that although the  $\text{NH}_2$  radical exists in the gas phase when a SNCR agent is employed, it would ultimately react with  $\text{NO}_x$  (e.g.  $\text{NO}$  and/or  $\text{NO}_2$ ) as given in equations 1 and 2, when a nitrogen-containing nonazide gas generant composition is also employed in the vehicle occupant protection system. Therefore, as best understood at the time of filing of the parent application, one of ordinary skill would understand that  $\text{NH}_2$  is produced as a radical upon decomposition of the SNCR agent and then reacts with the  $\text{NO}_x$  in the gas phase to produce nitrogen and water as ultimate combustion products.
5. I have also reviewed the parent application with regard to the chemical equations therein. As readily understood by one of ordinary skill in the art, I conclude that the chemical reactions combined with the text indicate that any nitrogen-containing gas generant composition suitable for use within a vehicle occupant protection system may be employed provided that  $\text{NO}_x$  is produced upon combustion of the gas generant. Additionally, one of ordinary skill in the art would readily understand that upon combustion of the gas generant composition, one mol of  $\text{NO}_x$  would be reacted with one mol of  $\text{NH}_2$  or one mol of  $\text{NH}_3$  depending on the equilibrium conditions at any given moment of the combustion reaction. See chemical equations numbered 1 and 2.
6. Based on comment "5" directly above, one of ordinary skill in the art would have understood as of August 12, 1996 that given any gas generant composition that is known to produce a certain amount of  $\text{NO}_x$ , for every mol of  $\text{NO}_x$  produced, at least one mol of  $\text{NH}_2$  or  $\text{NH}_3$  would be

necessary to reduce the  $\text{NO}_x$ . See equations numbered 1 and 2 and also see Example 2.

7. Relative to comments "5" and "6" directly above, when marketing a gas generant composition for use within a vehicle occupant protection system, customer requirements mandate quantification of the various gaseous species produced from combustion of any given gas generant composition, particularly within vehicle occupant protection systems. These requirements predate August 12, 1996. Furthermore, the limits on any given combustion product or species would be defined by the customer thereby indicating what instances for example, would require reduction of  $\text{NO}_x$ . Accordingly, one of ordinary skill in the art would readily know what species were produced from any given gas generant composition, and in what amounts, prior to determining whether or not to add a SNCR agent in the molar amounts defined in reactions 1 and/or 2.
8. Based on the above, it is my opinion that one of ordinary skill in the art upon reading the parent application would readily understand when to practice the invention defined in the parent application. Stated another way, when advised of the amounts of  $\text{NO}_x$  as predetermined by customer requirements, one of ordinary skill in the art would know what amount of SNCR agent to apply in heterogeneous relation to the gas generant composition, thereby reducing the amount of nitrogen oxides produced upon combustion of the gas generant composition. Accordingly, when employing a nitrogen-containing gas generant composition, one of ordinary skill in the art (in possession of laboratory data mandated by customer requirements) would know when application of a SNCR agent would be required. Excessive or undue experimentation would not be required because criteria necessary to evaluate the need of SNCR technology would already be developed. In essence, only review of available data would be necessary. Accordingly, as of August 12, 1996 the applicants of the above-referenced application sufficiently enabled one of ordinary skill in the art to make, use, and practice the invention particularly in view of: the examples and the chemical equations in the specification, the related art, the state of the art, and what was known to one of ordinary skill in the art at the time.


9. I have reviewed the parent application with regard to the difficulty of reducing NO<sub>x</sub> concentration in gas generator effluent gases. I conclude that one of ordinary skill in the art would readily agree that various factors in the design of the vehicle occupant protection system, such as inflator design, gas generant composition, and/or temperature regime throughout the inflator, (e.g. see the Examples) would affect the amount of NO<sub>x</sub> or other species produced. Nevertheless, the Examples indicate that regardless of these factors, NO<sub>x</sub> reduction is still accomplished by addition of an SNCR agent.
10. It should be emphasized that a certain amount of experimentation is required to address the customer requirements given above. Accordingly, any present or future gas generant compositions requiring the use of the SNCR technology would be readily apparent without the need for additional or undue experimentation.
11. I have reviewed the parent application with regard to the term "heterogeneous" as applied to the spatial relationship between the gas generant composition and the selective non-catalytic reducing agent. The ordinary meaning of the term is applicable, that is, the gas generant composition and the SNCR agent are separate compositions existing separate from each other. The term "**composition**" is also revealing in that it is defined by Webster to mean, "a product of mixing or combining various elements or ingredients". Accordingly, two heterogeneous compositions may also be stated to be two heterogeneous mixtures or two heterogeneous combinations. "**Heterogeneous**" is defined to mean, "1. different in kind; unlike; incongruous; 2. composed of parts of different kinds; having widely dissimilar elements or constituents; not homogeneous." "**Homogeneous**" is defined to mean, "1. of the same or a similar kind or nature; 2. of uniform structure or composition throughout."
12. It follows then that when the term "heterogeneous" is applied to the spatial relationship between the gas generant composition and the SNCR agent, it cannot be construed to mean a **uniform** mixture of a granulated oxidizer (e.g. potassium nitrate) and a granulated ammonium salt. When formulating a gas generant composition for a vehicle occupant protection



system, it is known and accepted that the gas generant composition must be of uniform structure and composition throughout (e.g. **homogeneous**). Therefore, if for the sake of argument potassium nitrate is accepted as a viable gas generant composition within a vehicle occupant protection system, heterogeneous distribution of the SNCR agent throughout the potassium nitrate granules would constitute a practice of the present invention; homogeneous distribution would form a homogeneous composition between potassium nitrate and the SNCR agent, not two heterogeneous compositions as required in the present invention.

13. As would have been known to one of ordinary skill in the art as of August 12, 1996, a gas generant composition in a vehicle occupant protection system includes at least a fuel and an oxidizer for a complete system. Potassium nitrate is an oxidizer and therefore represents only a portion of the gas generant composition. A gas generant composition would not only contain the oxidizer, but it would also contain a fuel to be a complete system. As such, a gas generant composition for use within a vehicle occupant protection system is defined by all of its constituents, not by one of its constituents such as the oxidizer.
14. In sum, after review of the parent application I conclude that one of ordinary skill in the art, in view of the prior art and in view of industry practice, would realize and understand how to make, use, and practice the invention as described in the parent application. Stated another way, one of ordinary skill in the art would know what nitrogen-containing gas generant compositions would be found within the scope of the invention characterized in the parent application and would also know at what point the SNCR technology described would be necessary. Additionally, one of ordinary skill in the art would be able to determine the amounts of SNCR agent required to reduce the nitrogen oxides given the laboratory data available due to customer requirements and given the equations numbered 1 and 2 as defined in the parent application.

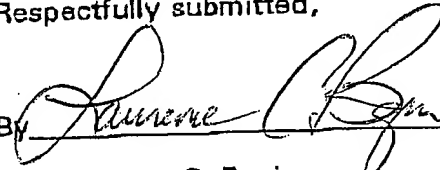
Further declarant sayeth not.

  
Graydon K. Williams 21 AUG 03  
Chief Chemist  
Automotive Systems Laboratory, Inc.

Respectfully submitted,

Date 8/21/03

Dinnin & Dunn, P.C.  
2701 Cambridge Court, Suite 500  
Auburn Hills, MI 48326

By   
Laurence C. Begin  
Reg. No. 42,310  
Phone: 248-364-2100  
Fax: 248-364-2200

## *Curriculum Vitae of Graylon K. Williams*

"Pyrotechnic Actuator," Blackburn, J.; Williams, G. K.; Burns, S. P.  
U. S. Patent 6,568,184, 2003.

"High Gas Yield Non-Azide Gas Generants," Khandhadia, P. S.; Burns, S. P.;  
Williams, G. K. U. S. Patent 6,210,505, 2001.

"Thermal Decomposition of Energetic Materials 72. Unusual Behavior of  
Substituted Furazan Compounds upon Flash Pyrolysis," Williams, G. K.;  
Brill, T. B. Combust. Flame, 1998, 114, 569.

"Thermal Decomposition of Energetic Materials 70. Kinetics of Organic Peroxide  
Decomposition Derived from the Filament Control Voltage of T-Jump/FTIR  
Spectroscopy," Williams, G. K.; Brill, T. B. Appl. Spectrosc., 1997, 51, 423.

"Toward Quantitative Thermodynamics and Kinetics of Pyrolysis of Bulk  
Materials at High Temperature and Pressure," Williams, G. K.; Brill, T. B.  
Mat. Res. Soc. Symp. Proc., 1996, 418, 163.

"Thermal Decomposition of Energetic Materials 68. Decomposition and  
Sublimation Kinetics of NTO and Evaluation of Prior Kinetic Data,"  
Williams, G. K.; Brill, T. B. J. Phys. Chem., 1995, 99, 12536.

"Thermal Decomposition of Energetic Materials 67. Hydrazinium Nitroformate (HNF)  
Rates and Pathways Under Combustion-like Conditions," Williams, G. K.;  
Brill, T. B. Combust. Flame, 1995, 102, 418.

"Surface Chemistry of Burning Explosives and Propellants," Brill, T. B.; Arisawa, H.;  
Brush, P. J.; Gongwer, P. E.; Williams, G. K. J. Phys. Chem., 1995, 99, 1384.

"Thermal Decomposition of Energetic Materials 66. Kinetic Compensation Effects in  
HMX, RDX, and NTO," Brill, T. B.; Gongwer, P. E.; Williams, G. K.  
J. Phys. Chem., 1994, 98, 12242.

"Thermal Decomposition of Energetic Materials 65. Conversion of Insensitive  
Explosives (NTO, ANTA) and Related Compounds to Polymeric Melon-Like Cyclic  
Azine Burn-rate Suppressants," Williams, G. K.; Palopoli, S. F.;  
Brill, T. B. Combust. Flame, 1994, 98, 197.

"Kinetics and Pathways of Hydrazinium Nitroformate (HNF) Decomposition Under  
Combustion-like Conditions," Williams, G. K.; Brill, T. B. *Gordon Research  
Conference*, New Hampton, NH, June 1994.

"Synthesis, Characterization, and Thermolysis of New Energetic Metal Complexes,"  
*Thiokol University IR & D Review Conference*, Ogden, UT, July 1992.

***EDUCATION:***

**Ph.D. Inorganic Chemistry** University of Delaware, October 1996. Advisor: Dr. Thomas B. Brill. Dissertation Title: "Kinetic and Mechanistic Decomposition Studies on Advanced Energetic Materials."

**M.S. Chemistry** University of Delaware, May 1993. Advisor: Dr. Thomas B. Brill. Thesis Title: "Synthesis, Characterization, and Thermolysis of Triazole Metal Complexes."

**B.S. Chemistry (ACS)** University of Central Oklahoma, December 1989.

## **Appendix D**

**All Office Action Responses From  
12/13/04 – 2/7/06**

IN THE UNITED STATES PATENT  
AND TRADEMARK OFFICE

Group Art Unit 3641  
Examiner Jack W. Keith

SEAN P. BURNS, et al.  
Serial No. 09/638,606  
Filed August 15, 2000

For: SELECTIVE NON-CATALYTIC REDUCTION  
(SNCR) OF TOXIC GASEOUS EFFLUENTS  
IN AIRBAG INFLATORS /

December 13, 2004

Commissioner For Patents  
Alexandria, Virginia 22313

Sir:

Responsive to the Restriction requirement dated November 12, 2004,  
Applicants response is as follows:

Relative to each of the items presented by the examiner, please note the  
following elections respective thereto.

- I a.) Tetrazole as a fuel material is elected;
- b.) alkaline earth metal as an oxidizer is elected; and
- c.) clay as a low temperature slag former is elected.
- II Ammonium sulfate is elected as a non-catalytic reducing compound.

The species is therefore believed to be a gas generant composition containing  
a tetrazole, an alkaline earth metal, and clay, and ammonium sulfate as a non-

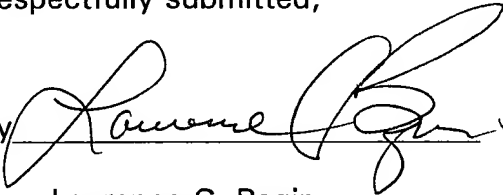
catalytic reducing compound. The claims readable therein are 3, 13 – 18, and 21 – 33.

Applicants have not calculated an additional fee to be due in connection with this paper. If the Applicants can be of any further assistance, the examiner is invited to contact the undersigned at the number given below.

Date 12/13/04

L.C. Begin & Associates, PLLC  
510 Highland Avenue  
PMB 403  
Milford, Michigan 48381-1586

Respectfully submitted,

By 

Laurence C. Begin  
Reg. No. 42310  
Phone (248) 889-5875  
FAX (248) 887-7664

IN THE UNITED STATES PATENT  
AND TRADEMARK OFFICE

Group Art Unit 3641  
Examiner Jack W. Keith

SEAN P. BURNS, et al.  
Serial No. 09/638,606  
Filed August 15, 2000

For: SELECTIVE NON-CATALYTIC REDUCTION  
(SNCR) OF TOXIC GASEOUS EFFLUENTS  
IN AIRBAG INFLATORS /

April 13, 2005

Commissioner For Patents  
Alexandria, Virginia 22313

Sir:

Responsive to the Restriction requirement dated November 12, 2004, and to the correspondence received from the patent office dated February 14, 2005, Applicants' response is as follows:

Relative to each of the items presented by the examiner, please note the following elections respective thereto.

- I a.) A fuel consisting of a tetrazole is elected;
  - b.) An oxidizer consisting of an alkaline earth metal is elected; and
  - c.) A slag former consisting of clay is elected.
- II A non-catalytic reducing compound consisting of ammonium sulfate is elected.



The elected species is therefore a gas generant composition consisting only of a tetrazole, an alkaline earth metal, and clay. The elected non-catalytic reducing compound consists only of ammonium sulfate as a non-catalytic reducing compound. The claims readable therein are 3, 13 – 18, and 21 – 33.

Applicants concurrently petition for a one-month extension of time and have calculated an associated additional fee of \$120.00 to be due in connection with this paper. Our credit card authorization is included herewith. The Commissioner is authorized to charge any deficiencies or credit any overage to Deposit Account No. 50-3238. If the Applicants can be of any further assistance, the examiner is invited to contact the undersigned at the number given below.

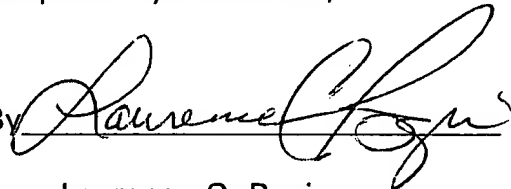
Date

4/13/05

L.C. Begin & Associates, PLLC  
510 Highland Avenue  
PMB 403  
Milford, Michigan 48381-1586

Respectfully submitted,

By



Laurence C. Begin  
Reg. No. 42310  
Phone (248) 889-5875  
FAX (248) 887-7664

IN THE UNITED STATES PATENT  
IN THE UNITED STATES PATENT  
AND TRADEMARK OFFICE

Group Art Unit 3643  
Examiner Jeffrey L. Gellner

**AMENDMENT AND  
REQUEST FOR RECONSIDERATION**

SEAN P. BURNS, et al.

Serial No. 09/638,606

Filed August 15, 2000

For: SELECTIVE NON-CATALYTIC REDUCTION  
(SNCR) OF TOXIC GASEOUS EFFLUENTS  
IN AIRBAG INFLATORS /

October 17, 2005

Commissioner For Patents  
Alexandria, Virginia 22313

Sir:

Responsive to the Office Action mailed out on July 15, 2005, Applicants  
amend the claims and request reconsideration for the reasons stated below.

**IN THE CLAIMS**

1. (cancelled)
2. (cancelled)
3. (currently amended) A vehicle occupant restraint system comprising:
  - an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a nitrogen-containing gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and
  - a selective non-catalytic reducing compound placed within said gas generator in physical contact with and in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds,wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.
4. (cancelled)
5. (cancelled)
6. (cancelled)
7. (cancelled)
8. (cancelled)
9. (cancelled)
10. (cancelled)
11. (cancelled)

12. (cancelled)

13. (previously presented) The vehicle occupant restraint system of claim 3 wherein said gas generant composition is extruded into a desirable shape and upon combustion yields gases comprising NO<sub>x</sub> gas, and, said reducing compound contains at least one mole of elemental nitrogen per one mole of NO<sub>x</sub> produced by the gas generant composition upon combustion and is discretely interspersed about the gas generant composition.

14. (previously presented) The vehicle occupant restraint system of claim 3 wherein said gas generant composition comprises at least one material of each of the following functional groups of materials – a) a fuel selected from the group of azole compounds consisting of triazole, aminotetrazole, tetrazole, bitetrazole, and metal salts of these compounds; b) an oxygen containing oxidizer compound selected from the group consisting of alkali metal, alkaline earth metal, lanthanide and ammonium nitrates and perchlorates or from the group consisting of alkali metal and alkaline earth metal chlorates and peroxides; and c) a low-temperature slag forming material which is sufficient in amount during combustion to cause the solid combustion particles to coalesce into easily filterable slag or clinkers but not so much as to make a low viscosity liquid, selected from the group consisting of silicon dioxide, boric oxide and vanadium pentoxide or from the group consisting of alkali metal silicates, borates, and carbonates or from the group consisting of naturally occurring clays and talcs, and, the gas generant composition is extruded into a desirable shape and combusts to yield gases comprising NO<sub>x</sub> gases, and, the reducing compound contains at least one mole of elemental nitrogen per one mole of NO<sub>x</sub> produced by the gas generating mixture upon combustion, and is interspersed about the gas generant composition.

15. (previously presented) The vehicle occupant restraint system of claim 3 wherein said nitrogen-containing gas generant composition produces nitrogen oxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

16. (previously presented) The vehicle occupant restraint system of claim 13 wherein said nitrogen-containing gas generant composition produces nitrogen oxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

17. (previously presented) The vehicle occupant restraint system of claim 14 wherein said nitrogen-containing gas generant composition produces nitrogen oxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

18. (previously presented) A vehicle occupant restraint system of Claim 3 wherein:

said selective non-catalytic reducing compound is selected from the group consisting of ammonium carbonate ((NH<sub>4</sub>)<sub>2</sub>CO<sub>3</sub>), ammonium sulfate

$((\text{NH}_4)_2\text{SO}_4)$ , ammonium chloride ( $\text{NH}_4\text{Cl}$ ), ammonium carbamate ( $\text{H}_2\text{NCO}_2\text{NH}_4$ ), and ammonium fluoride ( $\text{NH}_4\text{F}$ ).

19. (withdrawn) A vehicle occupant restraint system of Claim 3 wherein:  
said selective non-catalytic reducing compound is urea ( $\text{H}_2\text{NCONH}_2$ ).
20. (withdrawn) A vehicle occupant restraint system of Claim 3 wherein:  
said selective non-catalytic reducing compound is cyanuric acid ( $\text{HNCO}$ )<sub>3</sub>
21. (currently amended) A vehicle occupant restraint system comprising:
  - an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a nitrogen-containing gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and
  - a selective non-catalytic reducing compound placed within said gas generator in physical contact with and in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds, wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.
22. (previously presented) The vehicle occupant restraint system of claim 21 wherein said selective non-catalytic reducing compound is ammonium sulfate.

23. (currently amended) A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a nitrogen-containing nonazide gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and
  - a selective non-catalytic reducing compound placed within said gas generator in physical contact with and in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds, wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.
24. (previously presented) The vehicle occupant restraint system of claim 23 wherein said selective non-catalytic reducing compound is ammonium sulfate.
25. (previously presented) A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and
  - a selective non-catalytic reducing compound proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic

reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds,  
wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

26. (previously presented) The vehicle occupant restraint system of claim 25 wherein the gas generant composition is a nonazide gas generant composition and the selective non-catalytic reducing compound is ammonium sulfate.

27. (previously presented) A vehicle occupant restraint system comprising:  
an inflatable air bag;  
a gas generator for inflating said air bag;  
a gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof;  
and  
a selective non-catalytic reducing compound placed proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds  
wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

28. (previously presented) The vehicle occupant restraint system of claim 27 wherein the gas generant composition is a nonazide gas generant composition



and the selective non-catalytic reducing compound is ammonium sulfate.

29. (previously presented) A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a nonazide gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and
  - a selective non-catalytic reducing compound placed proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds,
- wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide and/or nitrogen dioxide produced upon combustion of said gas generant composition.
30. (previously presented) The vehicle occupant restraint system of claim 29 wherein said selective non-catalytic reducing compound is ammonium sulfate.
31. (previously presented) A vehicle occupant restraint system comprising:
- an inflatable air bag;
  - a gas generator for inflating said air bag;
  - a nitrogen-containing gas generant composition located within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and

a selective non-catalytic reducing compound placed proximate to and interspersed about said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

32. (previously presented) The vehicle occupant restraint system of claim 31 wherein said gas generant composition is a nonazide composition and said selective non-catalytic reducing compound is ammonium sulfate.

33. (previously presented) The vehicle occupant restraint system of Claim 31 wherein:

said selective non-catalytic reducing compound is selected from the group consisting of ammonium carbonate  $((\text{NH}_4)_2\text{CO}_3)$ , ammonium sulfate  $((\text{NH}_4)_2\text{SO}_4)$ , ammonium chloride  $(\text{NH}_4\text{Cl})$ , ammonium carbamate  $(\text{H}_2\text{NCO}_2\text{NH}_4)$ , and ammonium fluoride  $(\text{NH}_4\text{F})$ .

**REMARKS**

Applicants acknowledge with appreciation the allowability of claims 22, 24, 26, 28, 30, and 32 if rewritten in independent form to include all of the limitations of the base claim(s) and any intervening claim(s).

Claims 3, 13-18, 21, 23, 25, 27, 29, 31, and 33 stand rejected under 35 USC 103(a) as being unpatentable over Poole '588 in view of Poole et al. '854.

With regard to claims 3, 18, 21, 23, 25, 27, 29, and 31, and 33, the examiner states that among other things, Poole '588 discloses a gas generator containing a nitrogen-containing gas generant containing a tetrazole that forms a nitrogen oxide or dioxide upon combustion. However, the examiner correctly states that a selective non-catalytic reducing agent, or ammonium containing compound, is not disclosed.

The examiner again correctly states that '854 discloses ammonium carbonate at col. 2, lines 1-4. Nevertheless, this description in '854 also indicates that multi-chambers are employed to treat the gases.

Even so, the examiner should note that the references must be viewed in their entirety. For example, Poole '588 discloses a method of reducing nitrogen oxides and carbon monoxide. No alternative to this method is suggested, nor does Poole suggest that any other measure should be taken to reduce the NO<sub>x</sub>. For any alternative would supplant what is described below, in contravention of the invention described by Poole:

"...The invention importantly provides means of reducing the NO<sub>x</sub> and CO in gas

generant combustion products. This is accomplished by using an alkali metal salt mixed into the propellant. The primary effect is to reduce the NOx, but this allows formulation of the gas generant to provided an excess of oxygen in the combustion products, which reduces the amount of carbon monoxide or well as NOx.

This invention contemplates application of these means to any gas generant which produces NOx and carbon monoxide..." Column 8, lines 39-50 of Poole '588.

The examiner should note that the present invention is distinguishable from Poole '588 in that the selective non-catalytic reducing compound is heterogeneous or separate from the gas generant composition unlike Poole. Poole '588 requires that an alkali metal salt be mixed within the gas generant composition, not in heterogeneous relation therewith as claimed in the present invention. As such, if, as the examiner indicates, ammonium carbonate from Poole '854 were combined with the teachings of Poole '588, it would have to be combined within the gas generant composition. There is nothing within either Poole reference that would suggest that ammonium carbonate be placed proximate to (or in physical contact with) and heterogeneous to the gas generant composition, in contravention of Poole '588.

Stated another way, the examiner has not shown any motivation or suggestion in either reference that would result in the present application as claimed. Even if for the sake of argument it can be stated that all of the limitations of the claims in question are shown in the references when combined, without a showing of a motivation or suggestion to combine, a prima facie case of obviousness is simply not supported.

It should further be noted that Poole '854 apparently teaches away from providing carbon-containing constituents such as ammonium carbonate.

*"...It is not desirable to utilize a carbon-containing oxidizer with an oxygen-containing oxidizer because of the possibility of generating an undesired amount of carbon monoxide as one of the combustion products. The preferred oxidizer is potassium chlorate." Column 4, lines 29-36 of '854*

It can therefore be seen that Poole considered the use of additional carbon-containing oxidizers as problematic with regard to carbon monoxide. Poole's only suggestion was to avoid the use of carbon-containing oxidizers, not include them as additives to the propellant bed. Accordingly, Poole '854 apparently teaches away from the use of ammonium carbonate and therefore one of ordinary skill in the art would not in view of the entire teachings of '854 be motivated to heterogeneously combine ammonium carbonate with the gas generant as presently claimed. When a reference teaches away from an invention, it cannot concurrently suggest the same invention.

In sum, neither reference, '588 or '854, when taken alone or in combination with the other, suggests the present invention. Without a showing of proper motivation to combine to result in the invention claimed, an argument of obviousness essentially constitutes impermissible hindsight construction of the claims.

Applicant has amended to clarify the invention and to further distinguish from the prior art. No reference or combination of references of record teach the dispersing of an SNCR agent within a gas generant bed, whereby the SNCR agent is proximate to and heterogeneous with the gas generant as claimed in claims 25, 27, 29, and 31 (or in physical contact with, as amended in claims 3, 21, and 23). The examiner should note that neither reference describes both the heterogeneous relationship between the SNCR agent and the gas generant, and the proximate or physical relationship between the SNCR agent and the gas generant.

In essence, the applicant has solved the problem of reducing the NO<sub>x</sub> and carbon monoxide in the gaseous effluent in a manner distinct from the method described in '588, that is mixing an alkali metal salt within the gas generant composition, or, by treating the gaseous effluent of combustion in a plurality of chambers. The present invention therefore enables improvement of the effluent

quality without changing the gas generant composition or mixing within the gas generant composition. Furthermore, the design of the inflator is necessarily simpler given that a plurality of chambers is not required to treat the effluent as described by '854.

In view of the amendments, and in view of the comments given above, Applicants respectfully traverse the remaining rejections and courteously solicit the allowance of claims 3, 13-18, 21, 23, 25, 27, 29, 31, and 33, and passage of the subject application to issue.

Applicants have not calculated an additional fee to be due in connection with this paper. The Commissioner is authorized to charge Deposit Account No. 50-3238 for any deficiencies in connection with this paper. If the Applicants can be of any further assistance, the examiner is invited to contact the undersigned at the number given below.

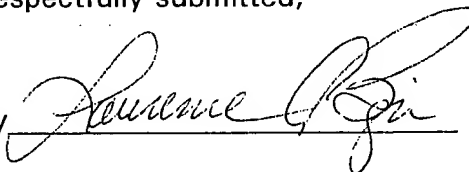
Date

10/17/05

L.C. Begin & Associates, PLLC  
510 Highland Avenue  
PMB 403  
Milford, Michigan 48381

Respectfully submitted,

By



Laurence C. Begin  
Reg. No. 42310  
Phone (248) 889-5875  
FAX (248) 887-7664

IN THE UNITED STATES PATENT  
AND TRADEMARK OFFICE

Group Art Unit 3643  
Examiner Jeffrey L. Gellner

**AMENDMENT**

SEAN P. BURNS, et al.

Serial No. 09/638,606

Filed August 15, 2000

For: SELECTIVE NON-CATALYTIC REDUCTION  
(SNCR) OF TOXIC GASEOUS EFFLUENTS  
IN AIRBAG INFLATORS /

February 7, 2006

Mail Stop AF  
Commissioner For Patents  
Alexandria, Virginia 22313

Sir:

Responsive to the Office Action having a mailing date of December 30, 2005,  
Applicants amend the claims as given below.

**IN THE CLAIMS**

1. (cancelled)
2. (cancelled)
3. (cancelled)
4. (cancelled)
5. (cancelled)
6. (cancelled)
7. (cancelled)
8. (cancelled)
9. (cancelled)
10. (cancelled)
11. (cancelled)
12. (cancelled)
13. (cancelled)
14. (cancelled)
15. (cancelled)
16. (cancelled)
17. (cancelled)
18. (cancelled)
19. (withdrawn) A vehicle occupant restraint system of Claim 3 wherein:



said selective non-catalytic reducing compound is urea ( $\text{H}_2\text{NCONH}_2$ ).

20. (withdrawn) A vehicle occupant restraint system of Claim 3 wherein:  
said selective non-catalytic reducing compound is cyanuric acid ( $\text{HNCO}$ )<sub>3</sub>)
21. (currently amended) A vehicle occupant restraint system comprising:  
an inflatable air bag;  
a gas generator for inflating said air bag;  
a nitrogen-containing gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and  
a selective non-catalytic reducing compound placed within said gas generator in physical contact with and in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is ~~selected from the group consisting of ammonium salts and amine containing compounds~~ ammonium sulfate,  
wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.
22. (cancelled)
23. (currently amended) A vehicle occupant restraint system comprising:  
an inflatable air bag;  
a gas generator for inflating said air bag;  
a nitrogen-containing nonazide gas generant composition within said

gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and

a selective non-catalytic reducing compound placed within said gas generator in physical contact with and in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is ~~selected from the group consisting of ammonium salts and amine-containing compounds~~ ammonium sulfate,

wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

24. (cancelled)

25. (currently amended) A vehicle occupant restraint system comprising:

an inflatable air bag;

a gas generator for inflating said air bag;

a nonazide gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and

a selective non-catalytic reducing compound proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is ~~selected from the group consisting of ammonium salts and amine-containing compounds~~ ammonium sulfate,

wherein at least one mol of the selective non-catalytic reducing

compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

26. (cancelled)

27. (currently amended) A vehicle occupant restraint system comprising:

an inflatable air bag;

a gas generator for inflating said air bag;

a nonazide gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and

a selective non-catalytic reducing compound placed proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is ~~selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds~~ ammonium sulfate,

wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

28. (cancelled)

29. (currently amended) A vehicle occupant restraint system comprising:

an inflatable air bag;

a gas generator for inflating said air bag;

a nonazide gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion

thereof; and

a selective non-catalytic reducing compound placed proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is ~~selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds~~ ammonium sulfate,

wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide and/or nitrogen dioxide produced upon combustion of said gas generant composition.

30. (cancelled)

31. (currently amended) A vehicle occupant restraint system comprising:

an inflatable air bag;

a gas generator for inflating said air bag;

a nitrogen-containing nonazide gas generant composition located within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and

a selective non-catalytic reducing compound placed proximate to and interspersed about said gas generant composition, wherein said selective non-catalytic reducing compound is ~~selected from the group consisting of ammonium salts~~ ammonium sulfate,

wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

Serial No. 09/638,606

Atty Docket No. GIO-007-US  
5702-00007

32. (cancelled)

33. (cancelled)

**REMARKS**

Applicants acknowledge with appreciation the allowability of claims 22, 24, 26, 28, 30, and 32 if rewritten in independent form to include all of the limitations of the base claim(s) and any intervening claim(s).

Accordingly, Applicants have amended claims 21, 23, 25, 27, 29, and 31 to contain the limitations of claims 22, 24, 26, 28, 30, and 32, respectively. As such, claims 22, 24, 26, 28, 30, and 32 have been cancelled. Claims 3, 13-18, and claims 21, 23, 25, 27, 29, 31, and 33 as previously presented have been cancelled without prejudice.

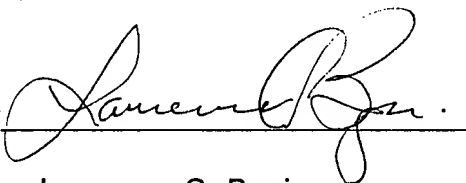
In view of the above, Applicants now believe claims 22, 24, 26, 28, 30, 32 to be in condition for allowance and courteously solicit allowance of the same and passage of the present application to issue.

Applicants have not calculated an additional fee to be due in connection with this paper. The Commissioner is authorized to charge Deposit Account No. 50-3238 for any deficiencies in connection with this paper. If the Applicants can be of any further assistance, the examiner is invited to contact the undersigned at the number given below.

Date 2/7/06

L.C. Begin & Associates, PLLC  
510 Highland Avenue  
PMB 403  
Milford, Michigan 48381

Respectfully submitted,

By 

Laurence C. Begin  
Reg. No. 42310  
Phone (248) 889-5875  
FAX (248) 887-7664

## **Appendix E**

**All Office Actions Prior to  
2/24/06**



## UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
 United States Patent and Trademark Office  
 Address: COMMISSIONER OF PATENTS AND TRADEMARKS  
 Washington, D.C. 20231  
 www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/638,606	08/15/2000	Sean P. Burns	GIO-007-US	1629

7590

01/02/2003

DUNN & DUNN, P.C.  
 Suite 2100  
 755 West Big Beaver Rd  
 Troy, Michigan 48684

EXAMINER

MILLER, EDWARD A

ART UNIT

PAPER NUMBER

3641-

DATE MAILED: 5/29/03 4/21/03  
 01/02/2003 /mar

Please find below and/or attached an Office communication concerning this application or proceeding.



## Office Action Summary

Application No.

09/638,606

Applicant(s)

BURNS ET AL.

Examiner

Edward A. Miller

Art Unit

3641

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 01 October 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 3 and 13-33 is/are pending in the application.
- 4a) Of the above claim(s) 19 and 20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1, 13-18 and 21-33 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

### Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

Art Unit: 3641

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
2. Claims 3, 13-18 and 21-33 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Burns et al. WO 98/06682.

It appears that this publication anticipates the instant claims. It appears that the instant situation is as set forth in *In re Lukach*, 169 USPQ 795, also *In re DeSeversky*, 177 USPQ 144, where the instant c-i-p application is somewhat narrower than the publication, more than a year prior to the instant filing date.

To the extent necessary, variation of specific notoriously well known details such as the various well known gas generating compositions would have been obvious to one of ordinary skill in the art. It is well settled that optimizing a result effective variable is well within the expected ability of a person of ordinary skill in the subject art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980), *In re Aller*, 220 F.2d 454, 105 USPQ 233 (CCPA 1955).

Applicants' arguments are not persuasive of error. To allege the application has basis in the parent fails to rebut the case law. Indeed, the opposite is true. Applicants' misquote the MPEP, which supports the examiner's position. Having a "basis" is not the same as "support" in the sense of 35 USC 112, 1<sup>st</sup> paragraph, as required in 35 USC 120. [Emphases added below.]

"MPEP 2133.01 Rejections of Continuation-In-Part (CIP) Applications

When applicant files a continuation-in-part whose claims are not **supported by** the parent application, the effective filing date is the filing date of the child CIP. Any prior art disclosing the invention or an obvious variant thereof having a critical reference date more than 1 year prior to the filing date of the child will bar the issuance of a patent under 35 U.S.C. 102(b). *Paperless Accounting v. Bay Area Rapid Transit System*, 804 F.2d 659, 665, 231 USPQ 649, 653 (Fed. Cir. 1986)."

35 U.S.C. 120 Benefit of earlier filing date in the United States.

"An application for patent for an invention **disclosed in the manner provided by the first paragraph of section 112 of this title** in an application previously filed in the United States...."

Art Unit: 3641

In the instant c-i-p, the gas generating composition of the parent was not disclosed as it is in the instant specification, nor were there limitations as found herein, to define over the prior art used in the parent. The changes are too numerous to cite fully, but they include the currently acceptable levels of toxic gas impurities, specification page 2, lines 10-12, the incorporation by reference of prior art near the bottom of page 1 of the specification, the gas generants being in extruded form, and what the gas generator compositions may include throughout. Further, the amounts of SNCR compound, found at specification page 5, lines 22-25, are more limited than in the parent application. Thus the instant claims, in view of the specification, do not find description support in the manner of 35 USC 112, 1<sup>st</sup> paragraph, in the parent application. Further, changes were made in the manner of deletions, which also present the issue of new matter, or the instant disclosure differs from that in the parent. This includes the elimination of ammonia per se as a SNCR compound.

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 3, 13-18 and 21-33 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The disclosure is not adequately enabling. The gas generating compositions and the parameters of the SNCR added, including amounts, etc., are critical or essential to the practice of the invention, but they are neither included in the claim(s) nor enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976). Note the MPEP in this regard.

Art Unit: 3641

## 2164.01 Test of Enablement

Any analysis of whether a particular claim is supported by the disclosure in an application requires a determination of whether that disclosure, when filed, contained sufficient information regarding the subject matter of the claims as to enable one skilled in the pertinent art to make and use the claimed invention. The standard for determining whether the specification meets the enablement requirement was cast in the Supreme Court decision of *Mineral Separation v. Hyde*, 242 U.S. 261, 270 (1916) which postured the question: is the experimentation needed to practice the invention undue or unreasonable? That standard is still the one to be applied. *In re Wands*, 858 F.2d 731, 737, 8 USPQ2d 1400, 1404 (Fed. Cir. 1988). Accordingly, even though the statute does not use the term "undue experimentation," it has been interpreted to require that the claimed invention be enabled so that any person skilled in the art can make and use the invention without undue experimentation. *In re Wands*, 858 F.2d at 737, 8 USPQ2d at 1404 (Fed. Cir. 1988).

Looking to the Wands factors, applicants state that the problems are difficult to solve, involving different ingredients as fuels oxidizers, additives, etc., and that attempts to improve NO<sub>x</sub> serve to worsen CO behavior, and vice versa. The problems are thus manifold and perplexing. On the other hand, applicants merely state that the compositions which can be improved by their technique can be determined by the ordinary artisan. Further, in the specific examples, none of the main ingredients are specified, only the SNCR compound. Thus, applicants admit the problem to be soluble at best with considerable difficulty, but they provide no guidance detail on how to solve the problem. From the cited prior art, there are as many as 5 or more ingredients, each of which may be varied from perhaps dozens or more for oxidizers, to an almost unlimited number of organic compounds for fuels, and then merely recite amines, amides, imides, ammonium salts, and so on, as the SNCR compound, which are also essentially unlimited in number, not to mention various additives as taught in the references. This is not to mention varying amounts of each, as well as any physical conformation that may be required as to closeness, compare Examples 3 and 4 in the specification which consider the gas generant beds, or the desirable reaction temperatures. Thus, it would require unreasonable experimentation to determine what works in what situation. Applicant has given at best the idea that a problem exists, and invites experimentation by the ordinary artisan to determine a solution.

Art Unit: 3641

5. Claims 3, 15, 18 and 21-33 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Blomquist '104.

Blomquist teaches, in the Abstract, the use of ammonium salts, including ammonium halides and ammonium sulfate, as coolants to reduce the reaction temperature of a gas generant composition, and thus reduce the amounts of CO and NO<sub>x</sub>. It may appear that the examples with ammonium chloride anticipate the broader claims, while substitution of ammonium sulfate would at least be obvious, if not deemed specifically taught in the anticipation sense. See col. 3, lines 34-38, col. 6, lines 12-14, and col. 7, line 20. This reference is applicable since the benefit of the parent application is denied as set forth above, and additionally in the parent application, the claims were at all times rejected under 35 USC 112, first paragraph, for a lack of proper description and/or enablement. While applicant may argue that the ammonium salt is part of the composition, this is not deemed adequately defined by the claims to exclude this reference. Applicants originally included language that the gas generant was extruded, e.g., separate bodies, but applicants chose to delete this limitation. The examiner chooses to read the terminology broadly. Something that would not be heterogeneous, would be the case of a solid solution gas generant including an ammonium salt, which is homogeneous. Further, it is known in the art to use powdered compositions, which would be heterogeneous granules of gas generant ingredients, with distinct coolant granules, which is notoriously well known and obvious. Variation of the specific location of the coolant ingredient would have been obvious to one of ordinary skill in the art. In any event, the gas generant of the claims is not defined to preclude this reading of the claims. Applicants cannot both have their (cake, e.g. broad) claims, and (eat it, e.g.) define over such references as this. Variation of such notoriously well known parameters would have been obvious to one of ordinary skill in the art. It is well settled that optimizing a result effective variable is well within the expected

Art Unit: 3641

ability of a person or ordinary skill in the subject art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980), *In re Aller*, 220 F.2d 454, 105 USPQ 233 (CCPA 1955).

6. Claims 3, 15, 21, 23, 25, 27, 29 and 31 rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over each of MacLaren et al., Poole '588, Highsmith et al. '014, Poole et al. '272, and Hurley et al.

This rejection is predicated based on the same reading of the claims as requiring no specific gas generating composition, nor any specific amounts, nor any specific amount of NO<sub>x</sub> performance and includes as SNCR compounds, amines (and derivatives), as well as ammonium salts in certain references. In Hurley et al., col. 8, "Table I", the sodium nitrite is a gas generant composition, wherein the nitrite contains nitrogen to generate nitrogen gas when reacted with the ammonium chloride (inherent SNCR compound). In Poole et al., '272 nitroguanidine comprises the gas generant and ammonium nitrate is the ammonium salt (inherent SNCR). In Poole '588, note col. 4, lines 24-30, and in col. 8, lines 29-50, the toxics of the gas generant are controlled by potassium 5-amino tetrazole, which is an amine and an amine derivative, added for applicants' purpose. Further, Poole '588 teach that the same ingredients may have dual uses, as in the paragraph bridging col. 6-7. Highsmith et al., col. 4, lines 1-13 and 20, teach ammonium salts of substituted amines (BTA compounds) which are both part of the nitrogen generating composition and an ammonium salt, inherent SNCR compound, a dual use as taught in Poole as is notoriously well known to one of ordinary skill in the art. MacLaren et al. teach different dual use compounds, melamine and dicyanamide, amine derivatives, stated to produce breathable gas per the Abstract thereof, and with low toxic NO<sub>x</sub> at col. 4, line 43 and col. 5, line 43. If necessary, variation of the specific ingredients and the arrangement thereof would have been obvious per the case law cited above.

Art Unit: 3641

7. Claims 14 and 17 rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. This is a new matter rejection. There is no apparent basis, and applicants have not pointed out such, for the recitations of what the gas generator ingredients are in these claims. This does not seem to have any basis in the specification as filed. Applicants are required to point out the basis therefore, or to cancel the new matter.

8. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

9. Claims 2, 15, 18 and 21-33 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over the claims of U.S. Patents No. 6,306,232 and 6,074,502. Although the conflicting claims are not identical, they are not patentably distinct from each other because of clear overlap. This involves the broad reading of the instant claim language as set forth above. Further, it involves the respective ammonium salts, for example, as inherent SNCR compounds and fuel.

10. Should applicants maintain the breadth believed to exist in the claims, as currently broadly read, applicants are reminded of their duty of disclosure relative to other patents they may have,

Art Unit: 3641

which similarly include ammonium salts or amines and derivatives, inherent SNCR compounds, and which may have good NO<sub>x</sub> results, re obviousness type double patenting. See MPEP 2004.

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Notably, this includes Katzakian et al. for solid solution homogeneous gas generating compositions. Poole '757 is the basic gas generating composition as to which Poole '588 is improved via addition of an amine/ amine derivative NO<sub>x</sub> reducer. Catanzarite teaches the use of powdered gas generating compositions, as alternative to pressed discs, e.g., at col. 11, lines 13-20, as well as that the coolant may be part of the main gas generating charge, commingled or separate in the same place, and also at col. 6, lines 60-68, and to generate non-toxic gas at col. 17, line 45, and with variation of physical form, layers, etc., at col. 19, lines 42-67.

12. Any inquiry concerning either this or an earlier communication from the Examiner should be directed to Examiner Edward A. Miller at (703) 306-4163. Examiner Miller may normally be reached Monday-Thursday, from 10 AM to 7 PM.

If attempts to reach Examiner Miller by telephone are unsuccessful, his supervisor Mr. Carone can be reached at (703) 306-4198. The Group fax number is (703) 305-7687.

If there is no answer, or for any inquiry of a general nature or relating to the application status, please call the Group receptionist at (703) 308-1113.

Miller/em  
December 28, 2002



← 3641



**Notice of References Cited**

Application/Control No.

09/638,606

Applicant(s)/Patent Under  
Reexamination  
BURNS ET AL.

Examiner

Edward A. Miller

Art Unit

3641

Page 1 of 1

**U.S. PATENT DOCUMENTS**

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-3,715,131	02-1973	Hurley et al.	280/736
	B	US-3,773,351	11-1973	Catanzarite, Vincent O.	280/738
	C	US-3,785,674	01-1974	Poole et al.	280/741
	D	US-5,035,757	07-1991	Poole, Donald R.	149/46
	E	US-5,139,588	08-1992	Poole, Donald R.	149/61
	F	US-5,545,272	08-1996	Poole et al.	149/48
	G	US-5,682,014	10-1997	Highsmith et al.	149/36
	H	US-5,847,315	12-1998	Katzakian et al.	149/36
	I	US-6,065,774	05-2000	Cabrera, Raul	149/36
	J	US-6,074,502	06-2000	Burns et al.	149/36
	K	US-6,143,104	11-2000	Blomquist, Harold R.	149/36
	L	US-6,306,232	10-2001	Khandhadia et al.	149/22
	M	US-			

**FOREIGN PATENT DOCUMENTS**

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

**NON-PATENT DOCUMENTS**

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)  
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/638,606	08/15/2000	Sean P. Burns	GIO-007-US	1629

7590 12/30/2005

L.C. BEGIN & ASSOCIATES, PLLC.  
510 HIGHLAND AVENUE  
PMB 403  
MILFORD, MI 48381-1586

EXAMINER

GELLNER, JEFFREY L

ART UNIT	PAPER NUMBER
----------	--------------

3643

DATE MAILED: 12/30/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/638,606

Applicant(s)

BURNS ET AL.

Examiner

Jeffrey L. Gellner

Art Unit

3643

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 17 October 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 3 and 13-33 is/are pending in the application.
- 4a) Of the above claim(s) 19 and 20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 3, 13-18, 21, 23, 25, 27, 29, 31, 33 is/are rejected.
- 7) ☒ Claim(s) 22, 24, 26, 28, 30 and 32 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3, 13-18, 21, 23, 25, 27, 29, 31, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Poole (US 5,139,588; document E on the 892 accompanying the office action that is paper no. 10) in view of Poole et al. (US 3,797,854).

As to claims 3, 18, 21, 23, 25, 27, 29, 31, and 33, Poole et al. ('588) discloses a vehicle occupant restraint system (abstract) comprising an inflatable air bag (inherent in abstract); a gas generator (col. 6 lines 39-65) for inflating the air bag; a nitrogen-containing gas generant ("tetrazole" of col. 5 lines 3-4) composition within the gas generator that forms nitrogen oxide or dioxide upon combustion (from col. 8 lines 39-50). Not disclosed is a selective non-catalytic reducing compound, that is an ammonium containing compound, placed within the gas generator in physical contact with and in heterogeneous relation to the gas generator composition. Poole et al. ('854), however, discloses a selective non-catalytic reducing compound ("ammonium carbonate" of col. 2 lines 1-4) that is placed within the gas generator in physical contact with and heterogeneous relation to the gas generator composition (from "then passes into a chamber containing ammonium carbonate" of col. 2 lines 1-3 in that the generated gas can be considered the gas generant composition and when it, the gas, encounters the ammonium carbonate the two

Art Unit: 3643

are in physical contact and in heterogeneous relation). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Poole et al. ('588) by adding a non-catalytic reducing compound as disclosed by Poole et al. ('854) so as to change the CO to CO<sub>2</sub> so as to reduce the amount of toxic gas in the system.

As to claims 13, 15-17, Poole ('588) as modified by Poole et al. ('854) further disclose the generant composition extruded into a desirable shape ("pellets" of examples of cols. 9 and 10 of Poole et al. ('588)), the generant producing nitrogen oxide (Poole et al. ('588) at 39-48), and the reducing compound discretely interspersed about the gas generant composition (from "chamber containing ammonium carbonate" of col. 2 lines 1-3 of Poole et al. ('545) with the reducing compound having one mole of elemental nitrogen per one mole of NO<sub>x</sub> produced by the gas generant composition.

As to claim 14, Poole ('588) as modified by Poole et al. ('854) further disclose tetrazole, alkaline earth metal, and clay (Poole ('588) at col. 6 lines 39-65).

### *Allowable Subject Matter*

Claims 22, 24, 26, 28, 30, and 32 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

### *Response to Arguments*

Applicant's arguments filed 17 October 2005 have been fully considered but they are not persuasive. Applicants' arguments are: (1) there is nothing in either Poole reference that

Art Unit: 3643

discloses or suggests that the ammonium carbonate be placed proximate to, in physical contact with, and heterogeneous to the gas generant composition (Remarks page 11, middle of page); and, (2) Poole "854 teaches away from the present invention because of the text at col. 4 lines 29-38 (Remarks page 11, middle of page)..

As to argument (1), Examiner considers the gas to be the gas generant composition as the composition interacts with the ammonium carbonate. At this instance and location, the gas generant composition is physically in contact with and heterogeneous with the ammonium carbonate.

As to argument (2), the Poole '854 reference is used for its disclosure found in US 3,558,785 (an apparent typographical error because this patent appears not deal with gas generation compositions). However, Poole '854 does, by itself, disclose use of ammonium carbonate with a gas generant composition in its background section. The Poole '854 invention, itself, is not germane to the instant invention or the instant rejection.

### *Conclusion*

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

Art Unit: 3643

CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffrey L. Gellner whose telephone number is 571.272.6887. The examiner can normally be reached on Monday-Friday, 8:30-4:00, alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Peter Poon can be reached on 571.272.6891. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Jeffrey L. Gellner  
Primary Examiner  
Art Unit 3643



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/638,606	08/15/2000	Sean P. Burns	GIO-007-US	1629

7590 10/20/2005

L.C. BEGIN & ASSOCIATES, PLLC.  
510 HIGHLAND AVENUE  
PMB 403  
MILFORD, MI 48381-1586

EXAMINER

GELLNER, JEFFREY L

ART UNIT	PAPER NUMBER
----------	--------------

3643

DATE MAILED: 10/20/2005

OCT 26 2005

Please find below and/or attached an Office communication concerning this application or proceeding.



**Notice of Non-Compliant  
Amendment (37 CFR 1.121)**

Application No.

09638606

Examiner

Gellner, Jeffrey L.

Applicant(s)

BURNS ET AL

Art Unit

3643

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

The amendment document filed on 17 October 2005 is considered non-compliant because it has failed to meet the requirements of 37 CFR 1.121. In order for the amendment document to be compliant, correction of the following item(s) is required.

THE FOLLOWING MARKED (X) ITEM(S) CAUSE THE AMENDMENT DOCUMENT TO BE NON-COMPLIANT:

- ☐ 1. Amendments to the specification:
- ☐ A. Amended paragraph(s) do not include markings.
  - ☐ B. New paragraph(s) should not be underlined.
  - ☐ C. Other \_\_\_\_\_.
- ☐ 2. Abstract:
- ☐ A. Not presented on a separate sheet. 37 CFR 1.72.
  - ☐ B. Other \_\_\_\_\_.
- ☐ 3. Amendments to the drawings:
- ☐ A. The drawings are not properly identified in the top margin as "Replacement Sheet," "New Sheet," or "Annotated Sheet" as required by 37 CFR 1.121(d).
  - ☐ B. The practice of submitting proposed drawing correction has been eliminated. Replacement drawings showing amended figures, without markings, in compliance with 37 CFR 1.84 are required.
  - ☐ C. Other \_\_\_\_\_.
- ☒ 4. Amendments to the claims:
- ☒ A. A complete listing of all of the claims is not present.
  - ☐ B. The listing of claims does not include the text of all pending claims (including withdrawn claims)
  - ☐ C. Each claim has not been provided with the proper status identifier, and as such, the individual status of each claim cannot be identified. Note: the status of every claim must be indicated after its claim number by using one of the following status identifiers: (Original), (Currently amended), (Canceled), (Previously presented), (New), (Not entered), (Withdrawn) and (Withdrawn-currently amended).
  - ☐ D. The claims of this amendment paper have not been presented in ascending numerical order.
  - ☒ E. Other: Remarks on separate page is missing from Amendment.

For further explanation of the amendment format required by 37 CFR 1.121, see MPEP § 714 and the USPTO website at <http://www.uspto.gov/web/offices/pac/dapp/opla/preognotice/officeflyer.pdf>.

**TIME PERIODS FOR FILING A REPLY TO THIS NOTICE:**

1. Applicant is given **no new time period** if the non-compliant amendment is an after-final amendment or an amendment filed after allowance. If applicant wishes to resubmit the non-compliant after-final amendment with corrections, the **entire corrected amendment** must be resubmitted within the time period set forth in the final Office action.
2. Applicant is given **one month**, or thirty (30) days, whichever is longer, from the mail date of this notice to supply the **corrected section** of the non-compliant amendment in compliance with 37 CFR 1.121, if the non-compliant amendment is one of the following: a preliminary amendment, a non-final amendment (including a submission for a request for continued examination (RCE) under 37 CFR 1.114), a supplemental amendment filed within a suspension period under 37 CFR 1.103(a) or (c), and an amendment filed in response to a *Quayle* action.

**Extensions of time** are available under 37 CFR 1.136(a) only if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action.

**Failure to timely respond** to this notice will result in:

**Abandonment** of the application if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action; or

**Non-entry** of the amendment if the non-compliant amendment is a preliminary amendment or supplemental amendment.

Eric V. Burns

Burns

Legal Instruments Examiner (LIE)

(571) 272-6580

Telephone No.

54

JUL 19 2005



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
 United States Patent and Trademark Office  
 Address: COMMISSIONER FOR PATENTS  
 P.O. Box 1450  
 Alexandria, Virginia 22313-1450  
 www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/638,606	08/15/2000	Sean P. Burns	GIO-007-US	1629

7590 07/15/2005  
 L.C. BEGIN & ASSOCIATES, PLLC.  
 510 HIGHLAND AVENUE  
 PMB 403  
 MILFORD, MI 48381-1586

EXAMINER

GELLNER, JEFFREY L

ART UNIT	PAPER NUMBER
----------	--------------

3643

DATE MAILED: 07/15/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/638,606

Applicant(s)

BURNS ET AL.

Examiner

Jeffrey L. Gellner

Art Unit

3643

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 13 April 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 3 and 13-33 is/are pending in the application.
- 4a) Of the above claim(s) 19 and 20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 3, 13-18, 21, 23, 25, 27, 29, 31 and 33 is/are rejected.
- 7) ☒ Claim(s) 22, 24, 26, 28, 30 and 32 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

Art Unit: 3643

## DETAILED ACTION

### *Election/Restrictions*

Applicant's election of the species combination - tetrazole, alkaline earth metal, clay, and ammonium sulfate - in the reply filed on 13 April 2005 and is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)). Claims 19- and 20 are withdrawn from examination because they are drawn to a non-elected species.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3, 13-18, 21, 23, 25, 27, 29, 31, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Poole (US 5,139,588; document E on the 892 accompanying the office action that is paper no. 10) in view of Poole et al. (US 3,797,854).

As to claims 3, 18, 21, 23, 25, 27, 29, 31, and 33, Poole et al. ('588) discloses a vehicle occupant restraint system (abstract) comprising an inflatable air bag (inherent in abstract); a gas generator (col. 6 lines 39-65) for inflating the air bag; a nitrogen-containing gas generant ("tetrazole" of col. 5 lines 3-4) composition within the gas generator that forms nitrogen oxide or

Art Unit: 3643

dioxide upon combustion (from col. 8 lines 39-50). Not disclosed is a selective non-catalytic reducing compound, that is an ammonium containing compound, placed within the gas generator in heterogeneous relation to the gas generator composition. Poole et al. ('854), however, discloses an selective non-catalytic reducing compound ("ammonium carbonate" of col. 2 lines 1-4) that is placed within the gas generator in heterogeneous relation to the gas generator composition (from "then passes into a chamber containing ammonium carbonate" of col. 2 lines 1-3). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Poole et al. ('588) by adding a non-catalytic reducing compound as disclosed by Poole et al. ('854) so as to change the CO to CO<sub>2</sub> so as to reduce the amount of toxic gas in the system.

As to claims 13, 15-17, Poole ('588) as modified by Poole et al. ('854) further disclose the generant composition extruded into a desirable shape ("pellets" of examples of cols. 9 and 10 of Poole et al. ('588)), the generant producing nitrogen oxide (Poole et al. ('588) at 39-48), and the reducing compound discretely interspersed about the gas generant composition (from "chamber containing ammonium carbonate" of col. 2 lines 1-3 of Poole et al. ('545) with the reducing compound having one mole of elemental nitrogen per one mole of NO<sub>x</sub> produced by the gas generant composition.

As to claim 14, Poole ('588) as modified by Poole et al. ('854) further disclose tetrazole, alkaline earth metal, and clay (Poole ('588) at col. 6 lines 39-65).

Art Unit: 3643

*Allowable Subject Matter*

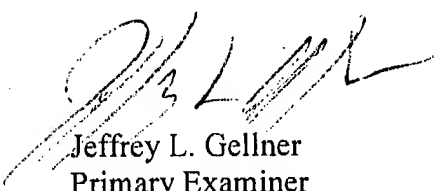
Claims 22, 24, 26, 28, 30, and 32 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

*Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffrey L. Gellner whose telephone number is 571.272.6887. The examiner can normally be reached on Monday-Friday, 8:30-4:00, alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Peter Poon can be reached on 571.272.6891. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Jeffrey L. Gellner  
Primary Examiner  
Art Unit 3643

**Notice of References Cited**

Application/Control No.

09/638,606

Applicant(s)/Patent Under

Reexamination

BURNS ET AL.

Examiner

Jeffrey L. Gellner

Art Unit

3643

Page 1 of 1

**U.S. PATENT DOCUMENTS**

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-3,797,854	03-1974	Poole et al.	280/741
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

**FOREIGN PATENT DOCUMENTS**

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

**NON-PATENT DOCUMENTS**

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

\*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)  
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.



UNITED STATES PATENT AND TRADEMARK OFFICE

FEB 17 2005

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/638,606	08/15/2000	Sean P. Burns	GIO-007-US	1629

7590 02/14/2005

L.C. BEGIN & ASSOCIATES, PLLC.  
510 HIGHLAND AVENUE  
PMB 403  
MILFORD, MI 48381-1586

EXAMINER
----------

KEITH, JACK W

ART UNIT	PAPER NUMBER
----------	--------------

3641

DATE MAILED: 02/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.



## DETAILED ACTION

### *Response to Amendment*

1. The reply filed on 12/13/2004 is not fully responsive to the prior Office Action because of the following omission(s) or matter(s): As set forth in the single species election requirement an open-ended election is considered to be non-responsive.

Applicant identified his election as:

- I.
  - a.) Tetrazole as a fuel material is elected;
  - b.) alkaline earth metal as an oxidizer is elected; and
  - c.) clay as a low temperature slag former is elected.
- II. Ammonium sulfate is elected as a non-catalytic reducing compound.

The species is therefore believed to be a gas generant composition **containing** a tetrazole, an alkaline earth metal, and clay, and ammonium sulfate as a non-catalytic reducing compound.

None of applicant's elections are considered to be closed-ended. As set forth in the examples of the restriction/election requirement. For example, elect a fuel material from those set forth in claim 14 (e.g., triazole only). The use of only or consisting of are considered to be closed-ended and therefore meet the requirements of the single species election.

Applicant in response to the notice of non-responsiveness is to provide an election in compliance with the single species restriction/election dated 11/12/2004.

See 37 CFR 1.111. Since the above-mentioned reply appears to be *bona fide*, applicant is given **ONE (1) MONTH or THIRTY (30) DAYS** from the mailing date of this notice, whichever is longer, within which to supply the omission or correction in order to


Art Unit: 3641

avoid abandonment. EXTENSIONS OF THIS TIME PERIOD MAY BE GRANTED UNDER 37 CFR 1.136(a).

2. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jack W. Keith whose telephone number is (703) 306-5752. The examiner can normally be reached on Monday-Thursday 6:30-5 p.m., with Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Carone can be reached on (703) 306-4198. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Jack W. Keith  
Primary Examiner  
Art Unit 3641

jwk  
February 10, 2005



# UNITED STATES PATENT AND TRADEMARK OFFICE

NOV 16 2004

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/638,606	08/15/2000	Sean P. Burns	GIO-007-US	1629

7590 11/12/2004

L.C. BEGIN & ASSOCIATES, PLLC.  
510 HIGHLAND AVENUE  
PMB 403  
MILFORD, MI 48381-1586

EXAMINER

KEITH, JACK W

ART UNIT	PAPER NUMBER
3641	

DATE MAILED: 11/12/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/638,606

Applicant(s)

BURNS ET AL.

Examiner

Jack W. Keith

Art Unit

3641

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 1 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 06 August 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 3 and 13-33 is/are pending in the application.
- 4a) Of the above claim(s) 19 and 20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☐ Claim(s) \_\_\_\_\_ is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☒ Claim(s) 3, 3-18, 21-33 are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Election/Restrictions*

1. Review of the disclosure indicates that a further restriction/election is warranted.

Any inconvenience to applicant is regretted.

2. The applicant is further required to elect a single species **for each** of the following under 35 USC 121 for the purpose of examination. This additional requirement is to facilitate examining due to the broad range of materials or compositions that can be included in applicant's vehicle occupant restraint system:

I. Elect the gas generant composition:

A. Elect a fuel material from those set forth in claim 14 (e.g., triazole only).

B. Elect an oxygen containing oxidizer compound from those set forth in claim 14 (e.g., alkali metal only).

C. Elect a low-temperature slag forming material from those set forth in claim 14 (e.g., silicon dioxide only).

II. Elect the non-catalytic reducing compound from those set forth in claim 18 (e.g., ammonium carbonate only).

*Note: In regard to the single species election of species IA, IB, IC and II the election cannot be open-ended (i.e., comprising). An open-ended election will be considered non-responsive.*

Art Unit: 3641

3. Applicant is advised that a reply to this requirement must include an identification of the species that is elected consonant with this requirement, and a listing of all claims readable thereon, including any claims subsequently added. An argument that a claim is allowable or that all claims are generic is considered nonresponsive unless accompanied by an election.

Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which are written in dependent form or otherwise include all the limitations of an allowed generic claim as provided by 37 CFR 1.141. If claims are added after the election, applicant must indicate which are readable upon the elected species. MPEP § 809.02(a).

Should applicant traverse on the ground that the species are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the species to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

4. Applicant is advised that the reply to this requirement to be complete must include an election of the invention to be examined even though the requirement be traversed (37 CFR 1.143).


5. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim

remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jack W. Keith whose telephone number is (703) 306-5752. The examiner can normally be reached on Monday-Thursday 6:30-5 p.m., with Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Carone can be reached on (703) 306-4198. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Jack W. Keith  
Primary Examiner  
Art Unit 3641

jwk  
November 9, 2004



# UNITED STATES PATENT AND TRADEMARK OFFICE



JUL 02 2004

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/638,606	08/15/2000	Sean P. Burns	GJO-007-US	1629

7590

04/15/2004

Laurence C Begin

L.C. Begin + Associates, PLLC

510 Highland Avenue

PMB 403

Milford, Michigan 48381-1588

EXAMINER

MILLER, EDWARD A

ART UNIT

PAPER NUMBER

3641

DATE MAILED: 04/15/2004

Please find below and/or attached an Office communication concerning this application or proceeding.



# Notice of Abandonment

Application No.

09/638,606

Examiner

Edward A. Miller

Applicant(s)

BURNS ET AL.

Art Unit

3641

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

This application is abandoned in view of:

1. ☒ Applicant's failure to timely file a proper reply to the Office letter mailed on 27 August 2003
  - (a) ☐ A reply was received on \_\_\_\_\_ (with a Certificate of Mailing or Transmission dated \_\_\_\_\_), which is after the expiration of the period for reply (including a total extension of time of \_\_\_\_\_ month(s)) which expired on \_\_\_\_\_.
  - (b) ☐ A proposed reply was received on \_\_\_\_\_, but it does not constitute a proper reply under 37 CFR 1.113 (a) to the final rejection.  
(A proper reply under 37 CFR 1.113 to a final rejection consists only of: (1) a timely filed amendment which places the application in condition for allowance; (2) a timely filed Notice of Appeal (with appeal fee); or (3) a timely filed Request for Continued Examination (RCE) in compliance with 37 CFR 1.114).
  - (c) ☐ A reply was received on \_\_\_\_\_ but it does not constitute a proper reply, or a bona fide attempt at a proper reply, to the non-final rejection. See 37 CFR 1.85(a) and 1.111. (See explanation in box 7 below).
  - (d) ☒ No reply has been received.
2. ☐ Applicant's failure to timely pay the required issue fee and publication fee, if applicable, within the statutory period of three months from the mailing date of the Notice of Allowance (PTOL-85).
  - (a) ☐ The issue fee and publication fee, if applicable, was received on \_\_\_\_\_ (with a Certificate of Mailing or Transmission dated \_\_\_\_\_), which is after the expiration of the statutory period for payment of the issue fee (and publication fee) set in the Notice of Allowance (PTOL-85).
  - (b) ☐ The submitted fee of \$\_\_\_\_\_ is insufficient. A balance of \$\_\_\_\_\_ is due.  
The issue fee required by 37 CFR 1.18 is \$\_\_\_\_\_. The publication fee, if required by 37 CFR 1.18(d), is \$\_\_\_\_\_.
  - (c) ☐ The issue fee and publication fee, if applicable, has not been received.
3. ☐ Applicant's failure to timely file corrected drawings as required by, and within the three-month period set in, the Notice of Allowability (PTO-37).
  - (a) ☐ Proposed corrected drawings were received on \_\_\_\_\_ (with a Certificate of Mailing or Transmission dated \_\_\_\_\_), which is after the expiration of the period for reply.
  - (b) ☐ No corrected drawings have been received.
4. ☐ The letter of express abandonment which is signed by the attorney or agent of record, the assignee of the entire interest, or all of the applicants.
5. ☐ The letter of express abandonment which is signed by an attorney or agent (acting in a representative capacity under 37 CFR 1.34(a)) upon the filing of a continuing application.
6. ☐ The decision by the Board of Patent Appeals and Interference rendered on \_\_\_\_\_ and because the period for seeking court review of the decision has expired and there are no allowed claims.
7. ☒ The reason(s) below:  
  
See next page.

Petitions to revive under 37 CFR 1.137(a) or (b), or requests to withdraw the holding of abandonment under 37 CFR 1.181, should be promptly filed to minimize any negative effects on patent term.

1. This application is abandoned in view of applicant's failure to submit a reply to the Office Action mailed on August 27, 2003, within the required period for reply.
2. This situation is unusual. The Office re-mailed Paper No. 10 on August 27, 2003, which is subsequent to the date of applicants' amendment, which was filed August 25, 2003. This amendment states that it was responsive to Paper No. 10, the Office action mailed April 21, 2003. Actually, Paper No. 10 was originally mailed January 02, 2003, then re-mailed February 24, 2003, then re-mailed again on April 21, 2003, and finally re-mailed on August 27, 2003.

Subsequent to the re-mailing of Paper No. 10 on August 27, 2003, the Office clerical staff further sent out a Notice of non-Compliant amendment on October 14, 2003, which stated that the amendment of August 25, 2003 was improper since it did not contain a complete listing of all claims.

3. Thus, at that time, October 14, 2003, there were two time periods running, one for the reply to re-mailed Paper No. 10, which started August 27, 2004, and a second time period for the nonresponsive amendment filed August 25, 2003. Nothing in the Notice of Non-Compliant Amendment October 14, 2003, referred to or modified Paper No. 10, re-mailed on August 27. Specifically, it neither restarted the period for response of Paper No. 10, re-mailed August 27, nor waived that statutory time for reply. Manifestly, a reply to an earlier Office action is not a reply to an office action re-mailed subsequent to the received date thereof. The statutory time for reply to Paper No. 10, re-mailed August 27, 2003 having expired, this application is abandoned.

4. Any inquiry concerning either this or an earlier communication from the Examiner should be directed to Examiner Edward A. Miller at (703) 306-4163. Examiner Miller may normally be reached Monday-Thursday, from 10 AM to 7 PM.

If attempts to reach Examiner Miller by telephone are unsuccessful, his supervisor Mr. Carone can be reached at (703) 306-4198. If there is no answer, or for any inquiry of a general nature or relating to the application status, please call the Group receptionist at (703) 308-1113.

Miller/em  
April 12, 2004

  
EDWARD A. MILLER  
PRIMARY EXAMINER

AUG 30 2002



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER OF PATENTS AND TRADEMARKS  
Washington, D.C. 20231  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/638,606	08/15/2000	Sean P. Burns	GIO-007-US	1629

Lawrence Bergin  
755 W Big Beaver Rd  
Suite 2100  
Troy MI 48064-4907

EXAMINER MILLER, EDWARD A	
ART UNIT 3641	PAPER NUMBER

DATE MAILED: 07/08/2002

8/25/02 Kar

Please find below and/or attached an Office communication concerning this application or proceeding.

COPY OF PAPERS  
ORIGINALLY FILED

RECEIVED  
JUL 26 2002  
GROUP 3600

# Office Action Summary

Application No.

09/638,606

Applicant(s)

BURNS ET AL.

Examiner

Edward A. Miller

Art Unit

3641

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 1 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 06 May 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 3 and 13-33 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☐ Claim(s) \_\_\_\_\_ is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

1. The reply filed on July 5, 2002 is not fully responsive to the prior Office Action because of the following omission(s) or matter(s):

In Paper No. 6, the claims were rejected under 35 USC 102(b) under longstanding case law, based on a publication of applicants', dated more than one year prior to the instant continuation-in-part application. The action stated that it appeared that all the claims were anticipated, and so on. In the reply, applicants stated that the publication was "equivalent" to the instant application, and failed to address the cited case law. If applicants maintain their traversal, they are required by the applicable rules, 37 CFR 1.111(b and c) to clearly and specifically point out how the claims avoid the rejection. To urge explicit or implicit basis in the parent application of which this is only in part a continuation, totally ignores the basis of the stated rejection including the case law it was based upon. A complete and proper reply is required, 37 CFR 1.135(b), to avoid abandonment.

Applicants have not pointed out how the changed scope of the instant claims, or the newly proffered claims, compared to the parent application, analogous to the publication cited, is identical to that originally set forth in the instant parent. Applicant has not discussed the cited case law. This, without more, must be acquiescence in the propriety and correctness of the cited case law, and its application to the instant case. Applicant is required to supply the omissions pointed out herein. The benefit of 37 CFR 1.135(c), based upon apparent inadvertence, is given.

See 37 CFR 1.111 and 1.135. Since the above-mentioned reply appears to be *bona fide*, applicant is given **ONE (1) MONTH or THIRTY (30) DAYS** from the mailing date of this notice, whichever is longer, within which to supply the omission or correction in order to avoid abandonment. **EXTENSIONS OF THIS TIME PERIOD MAY BE GRANTED UNDER 37 CFR 1.136(a).**

Application/Control Number: 09/638,606

Page 3

Art Unit: 3641

2. Any inquiry concerning either this or an earlier communication from the Examiner should be directed to Examiner Edward A. Miller at (703) 306-4163. Examiner Miller may normally be reached Monday-Thursday, from 10 AM to 7 PM.

If attempts to reach Examiner Miller by telephone are unsuccessful, his supervisor Mr. Carone can be reached at (703) 306-4198. The Group fax number is (703) 305-7687.

If there is no answer, or for any inquiry of a general nature or relating to the application status, please call the Group receptionist at (703) 308-1113.

Miller/em  
July 5, 2002

EDWARD A. MILLER  
PATENT EXAMINER



UNITED STATES PATENT AND TRADEMARK OFFICE

JAN 10 2002

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER OF PATENTS AND TRADEMARKS  
Washington, D.C. 20231  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/638,606	08/15/2000	Sean P. Burns	GIO-007-US	1629

7590

01/02/2002

Laurence C Begin  
Lyon PC  
Attorneys & Counselors  
3883 Telegraph Road Suite 207  
Bloomfield Hills, MI 48302-1476

EXAMINER

MILLER, EDWARD A

ART UNIT

PAPER NUMBER

3641

DATE MAILED: 01/02/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/638,606

Applicant(s)

BURNS ET AL.

Examiner

Edward A. Miller

Art Unit

3641

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 24 August 2001.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 3 and 13-20 is/are pending in the application.
- 4a) Of the above claim(s) 19 and 20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 3 and 13-18 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_



Art Unit: 3641

1. Applicant's election of Group II and Species A) in Paper No. 5, filed 24 August 2001, is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)). Claims 19-20 stand withdrawn as based on nonelected species.

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 3 rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Burns et al. WO 98/06682.

It appears that this publication anticipates the instant claims. It appears that the instant situation is as set forth in *In re Lukach*, 169 USPQ 795, also *In re DeSeversky*, 177 USPQ 144, where the instant c-i-p application is somewhat narrower than the publication, more than a year prior to the instant filing date.

To the extent necessary, variation of specific notoriously well known details such as the various well known gas generating compositions would have been obvious to one of ordinary skill in the art. It is well settled that optimizing a result effective variable is well within the expected ability

Art Unit: 3641

of a person or ordinary skill in the subject art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980), *In re Aller*, 220 F.2d 454, 105 USPQ 233 (CCPA 1955).

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Further, applicants should note the references of record in parent application S.N. 08/695,954.

6. Any inquiry concerning either this or an earlier communication from the Examiner should be directed to Examiner Edward A. Miller at (703) 306-4163. Examiner Miller may normally be reached Monday-Thursday, from 10 AM to 7 PM.

If attempts to reach Examiner Miller by telephone are unsuccessful, his supervisor Mr. Carone can be reached at (703) 306-4198. The Group fax number is (703) 305-7687.

If there is no answer, or for any inquiry of a general nature or relating to the application status, please call the Group receptionist at (703) 308-1113.

Miller/em  
December 30, 2001

EDWARD A. MILLER  
PRIMARY EXAMINER

**Notice of References Cited**

Application/Control No.

09/638,606

Applicant(s)/Patent Under  
Reexamination  
BURNS ET AL.

Examiner

Edward A. Miller

Art Unit

3641

Page 1 of 1

**U.S. PATENT DOCUMENTS**

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-5,478,542	12-1995	Chawla et al.	423/235
	B	US-5,853,683	12-1998	Gibbons et al.	423/235
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

**FOREIGN PATENT DOCUMENTS**

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N	3730141	03-1989	DE	Wolfrum	—
	O	98/06682	02-1998	WO	Burns et al.	—
	P					
	Q					
	R					
	S					
	T					

**NON-PATENT DOCUMENTS**

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

\*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)  
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

31 31 2001



**UNITED STATES DEPARTMENT OF COMMERCE  
Patent and Trademark Office**

Address: COMMISSIONER OF PATENTS AND TRADEMARKS  
Washington, D.C. 20231

CB

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
-----------------	-------------	----------------------	---------------------

09/538,606 08/15/00 BURNS

S GIO-007-US

EXAMINER
----------

PM82/0521

LAURENCE C BEGIN  
LYON PC  
ATTORNEYS & COUNSELORS  
3883 TELEGRAPH ROAD SUITE 207  
BLOOMFIELD HILLS MI 48302-1476

MILLER, E	
ART UNIT	PAPER NUMBER

3641  
DATE MAILED:

05/21/01

**Please find below and/or attached an Office communication concerning this application or proceeding.**

Commissioner of Patents and Trademarks

# Office Action Summary

Application No.

09/638,606

Applicant(s)

BURNS ET AL.

Examiner

Edward A. Miller

Art Unit

3641

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 1 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-12 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☐ Claim(s) \_\_\_\_ is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☒ Claims 1-12 are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

## Attachment(s)

- 15) ☐ Notice of References Cited (PTO-892)
- 16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_.
- 18) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_.
- 19) ☐ Notice of Informal Patent Application (PTO-152)
- 20) ☐ Other: \_\_\_\_\_

Art Unit: 3641

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-2, drawn to a composition, classified in class 149, subclass 21.
- II. Claims 3-4, drawn to a first device, classified in class 280, subclass 741.
- III. Claims 5-6, drawn to a method of making, classified in class 86, subclass 1.
- IV. Claims 7-10, drawn to a second device, classified in class 280, subclass 736.
- V. Claims 11-12, drawn to a method of using, classified in class 60, subclass 205.

2. The inventions are distinct, each from the other because of the following reasons:

3. Inventions II or IV, and I, are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because it appears that the subcombination is not per se patentable. The subcombination has separate utility such as in a device that is not an air bag restraint device, as is a manned space vehicle gas generator. Also, a subcombination is not generic to two separate combinations.

4. Inventions II and IV are independent each from the other. Group IV is independent from Group III, and Group II is independent from Group V. Group I is independent from Groups III and V. Group III is independent from Group V.

5. Inventions III and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the process can be used to make a device that does not have the extruded gas generating composition of Group II.

6. Inventions IV and V are related as product and process of use. The inventions can be shown to be distinct if either or both of the following can be shown: (1) the process for using the

Art Unit: 3641

product as claimed can be practiced with another materially different product or (2) the product as claimed can be used in a materially different process of using that product (MPEP § 806.05(h)). In the instant case the process can be used to make and use a device with the gas generating actually in the device, as opposed to a composition that may be separate from, but the gas is for use in, the device as claimed.

7. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

8. Applicant is advised that the reply to this requirement to be complete must include an election of the invention to be examined even though the requirement be traversed (37 CFR 1.143).

9. This application contains claims directed to the following patentably distinct species of the claimed invention:

- A) inventions with ammonium salt SNCR,
- B) inventions with amine SNCR, and
- C) inventions with amide or imide SNCR.

Applicant is required under 35 U.S.C. 121 to elect a single disclosed species for prosecution on the merits to which the claims shall be restricted if no generic claim is finally held to be allowable, regardless of which Group above is elected. Currently, claims 1-3, 5-8, 11 and 12 are generic.

Applicant is advised that a reply to this requirement must include an identification of the species that is elected consonant with this requirement, and a listing of all claims readable thereon, including any claims subsequently added. An argument that a claim is allowable or that all claims are generic is considered nonresponsive unless accompanied by an election.

Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which are written in dependent form or otherwise include all the limitations of

Art Unit: 3641

an allowed generic claim as provided by 37 CFR 1.141. If claims are added after the election, applicant must indicate which are readable upon the elected species. MPEP § 809.02(a).

Should applicant traverse on the ground that the species are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the species to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

10. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a petition under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

11. Any inquiry concerning either this or an earlier communication from the Examiner should be directed to Examiner Edward A. Miller at (703) 306-4163. Examiner Miller may normally be reached daily, except alternate Fridays, from about 9:30 AM to 7 PM.

If attempts to reach Examiner Miller by telephone are unsuccessful, his supervisor Mr. Carone can be reached at (703) 306-4198. The Group fax number is (703) 305-7687.

If there is no answer, or for any inquiry of a general nature or relating to the application status, please call the Group receptionist at (703) 308-1113.

Miller/em  
May 20, 2001

**EDWARD A. MILLER  
PRIMARY EXAMINER**



## **Appendix F**

**Office Action of 2/24/06**



# UNITED STATES PATENT AND TRADEMARK OFFICE



FEB 27 2006

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/638,606	08/15/2000	Sean P. Burns	GIO-007-US	1629

7590 02/24/2006

L.C. BEGIN & ASSOCIATES, PLLC.  
510 HIGHLAND AVENUE  
PMB 403  
MILFORD, MI 48381-1586

EXAMINER
----------

GELLNER, JEFFREY L

ART UNIT	PAPER NUMBER
----------	--------------

3643

DATE MAILED: 02/24/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/638,606

Applicant(s)

BURNS ET AL.

Examiner

Jeffrey L. Gellner

Art Unit

3643

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 09 February 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 19-21, 23, 25, 27, 29 and 31 is/are pending in the application.
- 4a) Of the above claim(s) 19 and 20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 21, 23, 25, 27, 29 and 31 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

Art Unit: 3643

### DETAILED ACTION

Upon reconsideration of the prior art, the allowability of claims 22, 23, 25, 27, 29, and 31 is withdrawn. A rejection of these claims with new art follows. Examiner regrets any inconvenience to Applicant.

#### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 21, 23, 25, 27, 29, and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Poole (US 5,139,588; document E on the 892 accompanying the office action that is paper no. 10) in view of Pacanowsky et al. (US 3,993,514).

As to claims 21, 23, 25, 27, 29, and 31, Poole et al. ('588) discloses a vehicle occupant restraint system (abstract) comprising an inflatable air bag (inherent in abstract); a gas generator (col. 6 lines 39-65) for inflating the air bag; a nitrogen-containing, non azide gas generant ("tetrazole" of col. 5 lines 3-4) composition within the gas generator that forms nitrogen oxide or dioxide upon combustion (from col. 8 lines 39-50). Not disclosed is a selective noncatalytic reducing compound, ammonium sulfate, is placed with the gas generant composition, wherein at least one mol of ammonium sulfate is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of the gas generant composition. Pacanowsky et al, however,

Art Unit: 3643

disclose the use of ammonium sulfate with a non-azide gas generant (col. 3 lines 1-8). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Poole et al. ('588) by adding a non-catalytic reducing compound of ammonium sulfate as disclosed by Pacanowsky et al. so as to change to reduce the flame temperature (Pacanowsky et al. at col. 3 lines 1-8) and to have at least one mol of ammonium sulfate is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of the gas generant composition depending upon the flame temperature desired.

### *Response to Arguments*

Applicant's arguments with respect to claims 21, 23, 25, 27, 29, and 31 have been considered but are moot in view of the new ground(s) of rejection.

### *Conclusion*

Applicant should note that claims 19 and 20 are dependent from a cancelled claim.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffrey L. Gellner whose telephone number is 571.272.6887. The examiner can normally be reached on Monday-Friday, 8:30-4:00, alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Peter Poon can be reached on 571.272.6891. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 3643

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Jeffrey L. Gellner  
Primary Examiner  
Art Unit 3643

**Notice of References Cited**

Application/Control No.

09/638,606

Applicant(s)/Patent Under  
Reexamination  
BURNS ET AL.

Examiner

Jeffrey L. Gellner

Art Unit

3643

Page 1 of 1

**U.S. PATENT DOCUMENTS**

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-3,993,514	11-1976	Pacanowsky et al.	149/19.5
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

**FOREIGN PATENT DOCUMENTS**

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

**NON-PATENT DOCUMENTS**

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

\*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)  
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

## **Appendix G**

**Response to Office Action of 2/24/06  
Filed 6/26/06**



IN THE UNITED STATES PATENT  
AND TRADEMARK OFFICE

Group Art Unit 3641  
Examiner Jack W. Keith

SEAN P. BURNS, et al.  
Serial No. 09/638,606  
Filed August 15, 2000

For: SELECTIVE NON-CATALYTIC REDUCTION  
(SNCR) OF TOXIC GASEOUS EFFLUENTS  
IN AIRBAG INFLATORS /

June 26, 2006

Commissioner For Patents  
Alexandria, Virginia 22313

Sir:

Responsive to the office action dated February 24, 2006, Applicants' response is  
as follows:

The amendment to the claims begins on page 2.

Remarks follow the amendments to the claims.

**IN THE CLAIMS**

1. (cancelled)
2. (cancelled)
3. (cancelled)
4. (cancelled)
5. (cancelled)
6. (cancelled)
7. (cancelled)
8. (cancelled)
9. (cancelled)
10. (cancelled)
11. (cancelled)
12. (cancelled)
13. (cancelled)
14. (cancelled)
15. (cancelled)
16. (cancelled)
17. (cancelled)
18. (cancelled)
  
19. (withdrawn) A vehicle occupant restraint system of Claim 3 wherein:  
said selective non-catalytic reducing compound is urea ( $\text{H}_2\text{NCONH}_2$ ).
  
20. (withdrawn) A vehicle occupant restraint system of Claim 3 wherein:  
said selective non-catalytic reducing compound is cyanuric acid ( $\text{HNCO}$ )<sub>3</sub>.
  
21. (currently amended) A vehicle occupant restraint system comprising:

an inflatable air bag;  
a gas generator for inflating said air bag;  
a nitrogen-containing gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and  
a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from ~~ammonium-sulfate~~ the group consisting of ammonium salts and amine-containing compounds,  
wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

22. (cancelled)

23. (currently amended) A vehicle occupant restraint system comprising:

an inflatable air bag;  
a gas generator for inflating said air bag;  
a nitrogen-containing nonazide gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and  
a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from ~~ammonium-sulfate~~ the group consisting of ammonium salts and amine-containing compounds,  
wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced

upon combustion of said gas generant composition.

24. (cancelled)

25. (currently amended) A vehicle occupant restraint system comprising:

an inflatable air bag;

a gas generator for inflating said air bag;

a gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and

a selective non-catalytic reducing compound proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from ~~ammonium sulfate~~ the group consisting of ammonium salts and amine-containing compounds,

wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

26. (cancelled)

27. (currently amended) A vehicle occupant restraint system comprising:

an inflatable air bag;

a gas generator for inflating said air bag;

a gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and

a selective non-catalytic reducing compound placed proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from ~~ammonium sulfate~~ the group consisting of ammonium salts, amides, imides, and amine-containing

compounds,

wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

28. (cancelled)

29. (currently amended) A vehicle occupant restraint system comprising:

an inflatable air bag;

a gas generator for inflating said air bag;

a nonazide gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and

a selective non-catalytic reducing compound placed proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from ~~ammonium sulfate~~ the group consisting of ammonium salts, amides, imides, and amine-containing compounds,

wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide and/or nitrogen dioxide produced upon combustion of said gas generant composition.

30. (cancelled)

31. (currently amended) A vehicle occupant restraint system comprising:

an inflatable air bag;

a gas generator for inflating said air bag;

a nitrogen-containing gas generant composition located within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon

combustion thereof; and

a selective non-catalytic reducing compound placed proximate to and interspersed about said gas generant composition, wherein said selective non-catalytic reducing compound is ~~ammonium-sulfate~~ selected from the group consisting of ammonium salts,

wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

32. (cancelled)

33. (cancelled)

34. (new) A vehicle occupant restraint system comprising:

an inflatable air bag;

a gas generator for inflating said air bag;

a nitrogen-containing gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and

a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds,

wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

35. (new) The vehicle occupant restraint system of claim 34 wherein said gas generant composition is extruded into a desirable shape and upon combustion yields gases comprising  $\text{NO}_x$  gas, and, said reducing compound contains at least one mole of elemental nitrogen per one mole of  $\text{NO}_x$  produced by the gas generant composition upon combustion and is discretely interspersed about the gas generant composition.

36. (new) The vehicle occupant restraint system of claim 34 wherein said gas generant composition comprises at least one material of each of the following functional groups of materials – a) a fuel selected from the group of azole compounds consisting of triazole, aminotetrazole, tetrazole, bitetrazole, and metal salts of these compounds; b) an oxygen containing oxidizer compound selected from the group consisting of alkali metal, alkaline earth metal, lanthanide and ammonium nitrates and perchlorates or from the group consisting of alkali metal and alkaline earth metal chlorates and peroxides; and c) a low-temperature slag forming material which is sufficient in amount during combustion to cause the solid combustion particles to coalesce into easily filterable slag or clinkers but not so much as to make a low viscosity liquid, selected from the group consisting of silicon dioxide, boric oxide and vanadium pentoxide or from the group consisting of alkali metal silicates, borates, and carbonates or from the group consisting of naturally occurring clays and talcs, and, the gas generant composition is extruded into a desirable shape and combusts to yield gases comprising  $\text{NO}_x$  gases, and, the reducing compound contains at least one mole of elemental nitrogen per one mole of  $\text{NO}_x$  produced by the gas generating mixture upon combustion, and is interspersed about the gas generant composition.

37. (new) The vehicle occupant restraint system of claim 34 wherein said nitrogen-containing gas generant composition produces nitrogen oxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition,

whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

38. (new) The vehicle occupant restraint system of claim 35 wherein said nitrogen-containing gas generant composition produces nitrogen oxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

39. (new) The vehicle occupant restraint system of claim 36 wherein said nitrogen-containing gas generant composition produces nitrogen oxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

40. (new) A vehicle occupant restraint system of Claim 34 wherein:  
said selective non-catalytic reducing compound is selected from the group consisting of ammonium carbonate  $((\text{NH}_4)_2\text{CO}_3)$ , ammonium sulfate  $((\text{NH}_4)_2\text{SO}_4)$ , ammonium chloride  $(\text{NH}_4\text{Cl})$ , ammonium carbamate  $(\text{H}_2\text{NCO}_2\text{NH}_4)$ , and ammonium fluoride  $(\text{NH}_4\text{F})$ .

41. (new) The vehicle occupant restraint system of claim 21 wherein said selective non-catalytic reducing compound is ammonium sulfate.

42. (new) The vehicle occupant restraint system of claim 23 wherein said selective non-catalytic reducing compound is ammonium sulfate.



43. (new) The vehicle occupant restraint system of claim 25 wherein the gas generant composition is a nonazide gas generant composition and the selective non-catalytic reducing compound is ammonium sulfate.
44. (new) The vehicle occupant restraint system of claim 27 wherein the gas generant composition is a nonazide gas generant composition and the selective non-catalytic reducing compound is ammonium sulfate.
45. (new) The vehicle occupant restraint system of claim 29 wherein said selective non-catalytic reducing compound is ammonium sulfate.
46. (new) The vehicle occupant restraint system of claim 31 wherein said gas generant composition is a nonazide composition and said selective non-catalytic reducing compound is ammonium sulfate.
47. (new) The vehicle occupant restraint system of Claim 31 wherein:  
said selective non-catalytic reducing compound is selected from the group consisting of ammonium carbonate  $((\text{NH}_4)_2\text{CO}_3)$ , ammonium sulfate  $((\text{NH}_4)_2\text{SO}_4)$ , ammonium chloride  $(\text{NH}_4\text{Cl})$ , ammonium carbamate  $(\text{H}_2\text{NCO}_2\text{NH}_4)$ , and ammonium fluoride  $(\text{NH}_4\text{F})$ .

**REMARKS**

Claims 21, 23, 25, 27, 29, and 31 stand rejected as being unpatentable over Poole '588 in view of Pacanowsky. Applicants have responded by reinstating the former language of these claims, and adding new claims 40-47 corresponding to the use of ammonium sulfate. Accordingly, the references cited are now more pertinent to claims 40-47. Applicants note that neither reference when taken alone or in combination with the other, describes or suggests a discrete SNCR agent, ammonium sulfate, and a separate gas generant composition. Poole has been commented on in past office action responses, and the same arguments are herein incorporated by reference as if fully stated herein. On the other hand, Pacanowsky does not describe the use of ammonium sulfate as a discrete nitrogen reducing compound, but instead describes the use of ammonium sulfate within a composition, thereby attenuating the affects of acceleration. As such, Pacanowsky does not describe nor suggest the claims as presently claimed.

Other claims presently added are basically the claims previously cancelled. As such, original claims 3, 13-18, 22, 24, 26, 28, 30, and 32 are now again presented for reconsideration by the examiner. Arguments previously presented are incorporated by reference as if fully stated herein. Applicants believe these claims to be allowable for the reasons previously stated.

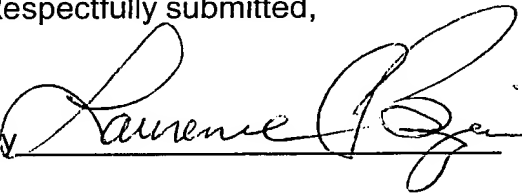
Accordingly, Applicants courteously petition for reconsideration of the standing rejections, allowance of the pending claims, and passage of the application to issue.

Applicants concurrently petition for a one-month extension of time and have calculated an associated additional fee of \$120.00 to be due in connection with this paper. Our credit card authorization is included herewith. The Commissioner is authorized to charge any deficiencies or credit any overage to Deposit Account No. 50-3238. If the Applicants can be of any further assistance, the examiner is invited to contact the undersigned at the number given below.

Date 6/26/06

L.C. Begin & Associates, PLLC  
510 Highland Avenue  
PMB 403  
Milford, Michigan 48381-1586

Respectfully submitted,

By 

Laurence C. Begin  
Reg. No. 42310  
Phone (248) 889-5875  
FAX (248) 887-7664

## **Appendix H**

**Final Office Action of 9/25/06**



# UNITED STATES PATENT AND TRADEMARK OFFICE

SEP 27 2006

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/638,606	08/15/2000	Sean P. Burns	GIO-007-US	1629

7590 09/25/2006

L.C. BEGIN & ASSOCIATES, PLLC.  
510 HIGHLAND AVENUE  
PMB 403  
MILFORD, MI 48381-1586

EXAMINER

GELLNER, JEFFREY L

ART UNIT	PAPER NUMBER
----------	--------------

3643

DATE MAILED: 09/25/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/638,606

Applicant(s)

BURNS ET AL.

Examiner

Jeffrey L. Gellner

Art Unit

3643

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 26 June 2006.  
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 19-21, 23, 25, 27, 29, 31 and 34-47 is/are pending in the application.  
4a) Of the above claim(s) 19 and 20 is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 21, 23, 25, 27, 29, 31 and 34-47 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.  
10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)  
3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_  
5) ☐ Notice of Informal Patent Application  
6) ☐ Other: \_\_\_\_\_

Art Unit: 3643

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 21, 23, 25, 27, 29, 31, and 34-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Poole (US 5,139,588; document E on the 892 accompanying the office action that is paper no. 10) in view of Pacanowsky et al. (US 3,993,514).

As to claims 21, 23, 25, 27, 29, 31, 34, and 40-47, Poole et al. ('588) discloses a vehicle occupant restraint system (abstract) comprising an inflatable air bag (inherent in abstract); a gas generator (col. 6 lines 39-65) for inflating the air bag; a nitrogen-containing, non azide gas generant ("tetrazole" of col. 5 lines 3-4) composition within the gas generator that forms nitrogen oxide or dioxide upon combustion (from col. 8 lines 39-50). Not disclosed is a selective noncatalytic reducing compound, ammonium salt, is placed with the gas generant composition, wherein at least one mol of ammonium sulfate is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of the gas generant composition. Pacanowsky et al, however, disclose the use of ammonium sulfate with a non-azide gas generant (col. 3 lines 1-8). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Poole et al. ('588) by adding a non-catalytic reducing compound of ammonium sulfate as disclosed by Pacanowsky et al. so as to change to reduce the flame

Art Unit: 3643

temperature (Pacanowsky et al. at col. 3 lines 1-8) and to have at least one mol of ammonium sulfate is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of the gas generant composition depending upon the flame temperature desired.

As to claim 35, Poole et al. ('588) and Pacanowsky et al. further disclose compression molding (for example, col. 9, example 1 of Poole et al. ('588)) and NO<sub>x</sub> gas produced upon combustion (col. 8, lines 39-47 of Poole et al. ('588)). Not disclosed are extrusion into a desirable shape, at least one mole of elemental N per mole of NO<sub>x</sub>, and the reducing compound discretely interspersed about the gas generant composition. Pacanowsky et al., however, discloses the reducing compound discretely interspersed about the gas generant composition (col. 4 lines 53-68). It would have been obvious to one of ordinary skill in the art at the time of the invention to further modify the system of Poole et al. ('588) as modified by Pacanowsky et al. by interspersing as disclosed by Pacanowsky et al. so as to optimize reaction rates and to extrude the composition into a desired shape so as to make the system more useable and to have at least one mole of elemental N per mole of NO<sub>x</sub> depending upon needs of the system.

As to claim 36, Poole et al. ('588) and Pacanowsky et al. further disclose tetrazole (col. 6 lines 39-46 of Poole et al. ('588)), alkaline earth metal lanthanide (col. 6 lines 47-51 of Poole et al. ('588)), a low temperature slag of clay (col. 6 lines 58-65 of Poole et al. ('588)). Not disclosed are extrusion into a desirable shape, at least one mole of elemental N per mole of NO<sub>x</sub>, and the reducing compound discretely interspersed about the gas generant composition. Pacanowsky et al., however, discloses the reducing compound discretely interspersed about the gas generant composition (col. 4 lines 53-68). It would have been obvious to one of ordinary skill in the art at the time of the invention to further modify the system of Poole et al. ('588) as



Art Unit: 3643

modified by Pacanowsky et al. by interspersing as disclosed by Pacanowsky et al. so as to optimize reaction rates and to extrude the composition into a desired shape so as to make the system more useable and to have at least one mole of elemental N per mole of NO<sub>x</sub> depending upon needs of the system.

As to claims 37-39, Poole et al. ('588) and Pacanowsky et al. further disclose nitrogen oxide and nitrogen dioxide (from "oxides of nitrogen (NO<sub>x</sub>)" of col. 2 lines 6-12 of Poole et al. ('588)). Not disclosed is the reducing compound proximate to and discretely interspersed about the gas generant composition. Pacanowsky et al., however, discloses the reducing compound discretely interspersed about the gas generant composition (col. 4 lines 53-68). It would have been obvious to one of ordinary skill in the art at the time of the invention to further modify the system of Poole et al. ('588) as modified by Pacanowsky et al. by interspersing as disclosed by Pacanowsky et al. so as to optimize reaction rates and to have the reducing compound proximate to the gas generant composition to add more reducing compound so as to further cool the system.

### *Response to Arguments*

Applicant's arguments filed 26 June 2006 have been fully considered but they are not persuasive. Applicants' arguments are: (1) neither Poole et al. ('588) nor Pacanowsky et al. disclose a discrete selectively non-catalytic reducing (SNCR) agent, ammonium sulfate, and a separate gas generant composition; (Remarks page 1, 1<sup>st</sup> para.); and, (2) Pacanowsky et al. does not describe the use of ammonium sulfate as a discrete nitrogen compound but instead within the composition which would attenuate the affects of acceleration (Remarks page 10, 1<sup>st</sup> para.).

Art Unit: 3643

As to arguments (1) and (2), Examiner considers Pacanowsky et al. to disclose ammonium sulfate with a separate gas generation composition (see for example, col. 4 lines 63-68 of Pacanowsky et al.). The ammonium sulfate in either the Poole et al. ('588) composition or the Pacanowsky et al. composition would function, in part, as a selectively non-catalytic reducing (SNCR) agent because it is well decided that if a composition is physically the same, it must have the same properties (see MPEP 2112.01(II)). Pacanowsky et al. discloses that ammonium sulfate functions to both reduce the effect of acceleration on burn characteristics of a composition and to reduce flame temperature of the composition (Pacanowsky et al. at col. 3 lines 1-8). Examiner considers ammonium sulfate to have a third effect - acting as a discrete SNCR agent.

### ***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

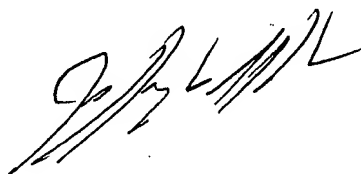
A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Art Unit: 3643

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffrey L. Gellner whose telephone number is 571.272.6887. The examiner can normally be reached on Monday-Friday, 8:30-4:00, alternate.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Peter Poon can be reached on 571.272.6891. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Jeffrey L. Gellner  
Primary Examiner  
Art Unit 3643

## **Appendix I**

### **Cited References:**

- 1) Pancanowsky et al., U.S. Patent No.  
3,993,514**
- 2) Poole U.S. Patent No. 5,139,588**



US005139588A

**United States Patent** [19]**Poole**[11] **Patent Number:** **5,139,588**[45] **Date of Patent:** \* **Aug. 18, 1992**[54] **COMPOSITION FOR CONTROLLING  
OXIDES OF NITROGEN**[75] **Inventor:** Donald R. Poole, Woodinville, Wash.[73] **Assignee:** Automotive Systems Laboratory, Inc.,  
Farmington Hills, Mich.[\*] **Notice:** The portion of the term of this patent  
subsequent to Jul. 30, 2008 has been  
disclaimed.[21] **Appl. No.:** 685,316[22] **Filed:** Apr. 15, 1991**Related U.S. Application Data**[63] Continuation-in-part of Ser. No. 601,528, Oct. 23, 1990,  
Pat. No. 5,084,118.[51] **Int. Cl.<sup>5</sup>** ..... C06B 31/02[52] **U.S. Cl.** ..... 149/61; 149/77;  
149/63[58] **Field of Search** ..... 149/85, 77, 61[56] **References Cited****U.S. PATENT DOCUMENTS**

5,035,757 7/1991 Poole ..... 149/46

*Primary Examiner*—Stephen J. Lechert, Jr.  
*Attorney, Agent, or Firm*—Lyon & Delevie[57] **ABSTRACT**

A gas generant composition devoid of azides which yields solid combustion products which are easily filtered rendering the gases useful for inflating automobile occupant restraint bags and further providing a reduction in the amount of toxic oxides of nitrogen in the produced gases.

**25 Claims, No Drawings**

## COMPOSITION FOR CONTROLLING OXIDES OF NITROGEN

### REFERENCE TO A RELATED APPLICATION

This application is a continuation-in-part of U.S. patent application Ser. No. 601,528 filed Oct. 23, 1990, for an invention entitled, "Azide-Free Gas Generant Composition with Easily Filterable Combustion Products" now U.S. Pat. No. 5,084,118.

### BACKGROUND OF THE INVENTION

#### 1. Field Of The Invention

Gas generating compositions for inflating occupant restraint devices of over-the-road vehicles have been under development worldwide for many years and numerous patents have been granted thereon. Because of strict requirements relating to toxicity of the inflating gases, most gas generants now in use are based on inorganic azides, and especially sodium azide. One advantage of such known sodium azide gas generants is that the solid combustion products thereof generally produce a slag or "clinkers" which are easily filtered, resulting in a relatively clean gas. The ability of a gas generant to form a slag is a great advantage when the gases are used for inflation purposes, especially when the gases must be filtered as in the inflation of an automobile occupant restraint bag.

However, the use of the sodium azide, or other azides as a practical matter, results in extra expense and risk in gas generant manufacture due to the extreme toxicity of unfired azides. In addition, the potential hazard and disposal problem of unfired inflation devices must be considered. Thus, a nonazide gas generant exhibits a significant advantage over an azide-based gas generant because of such toxicity related concerns.

A fundamental problem that must be solved when using nonazide based gas generants is that it is easier to formulate slagging gas generants based on sodium azide than nonazide types because the combustion temperature is relatively low with azide-based gas generants. For example, the combustion temperature of a sodium azide/iron oxide slagging type generant is 969° C. (1776° F.) whereas, nonazide slagging type generants heretofore known have exhibited a combustion temperature of 1818° C. (3304° F.). Moreover, many common solid combustion products which might be expected from nonazide gas generants are liquids at the combustion temperature exhibited and are therefore difficult to filter out of the gas stream. For example, potassium carbonate melts at 891° C. and sodium silicate melts at approximately 1100° C.

The formation of solid combustion products which coalesce at high combustion temperatures, and at high gas flow rates, requires a special combination of materials. Early attempts at formulating nonazide gas generants resulted in semi-solid combustion products that were difficult to filter. It has been found that combustion products which are liquid at the combustion temperature must be cooled until solidified before filtering is successful because liquid products penetrate and clog the filter. It has also been found that cooling of the liquid combustion products results in cooling of the gas, which requires the use of more gas generant. A cooled gas is relatively less efficient for inflation purposes, especially with an aspirator system. The additional gas

generant, in turn, requires more cooling and an additional filter as well as a larger combustion chamber.

Most azide-free, gas generant compositions provide a higher yield of gas (moles of gas per gram of gas generant) than conventional occupant restraint gas generants.

Although azide-free gas generating compositions offer numerous advantages over azide-based gas generants, it has been found difficult to produce gases which have sufficiently low levels of toxic substances. The toxic gases which are the most difficult to control are the oxides of nitrogen (NOx) and carbon monoxide (CO).

Most azide-free gas generants consist of carbon and nitrogen containing ingredients which, upon combustion, produce small, but undesirable levels of NOx and CO in addition to the desired products, nitrogen and carbon dioxide.

In combustion processes involving compounds containing both nitrogen and carbon it is possible to reduce or eliminate the CO by increasing the ratio of oxidizer to fuel. In this case, the extra oxygen oxidizes the CO to carbon dioxide. Unfortunately, however, this approach results in increased amounts of NOx.

The ratio of oxidizer to fuel may also be lowered to eliminate excess oxygen and provide a fuel rich condition which reduces the amount of NOx produced. This approach, however, results in increased amounts of CO.

Even though it is possible, by means of chemical equilibrium calculations, to find conditions of temperatures, pressure and gas generant composition which could reduce both NOx and CO to nontoxic levels it has been very difficult to accomplish this result in actual practice.

The aforesaid problems are solved by the present invention, which discloses several types of nonazide gas generants that yield solid combustion products which form a slag or clinkers at the relatively high combustion temperatures encountered with nonazide gas generants. The gas generants disclosed herein allow the use of simple, relatively inexpensive filters which cool the gas less and result in better pumping in an aspirated system. Taken together, these factors result in a simpler, less expensive and smaller airbag inflation system.

A problem solved by a preferred embodiment of this invention is that the NOx is controlled by means which are effective even though a limited amount of excess oxygen is present. This allows reduction of the CO level by the excess oxygen while, at the same time, lowering the NOx concentration to acceptable values.

#### 2. Description of the Prior Art

An example of prior art teachings relating to the subject matter of the instant invention is found in European Patent No. 0,055,547 entitled, "Solid Compositions for Generating Nitrogen, The Generation of Nitrogen Therefrom and Inflation of Gas Bags Therewith". This patent describes use of alkali or alkaline earth metal salts of a hydrogen-free tetrazole compound and oxidizers of sodium nitrate, sodium nitrite and potassium nitrate or alkaline earth nitrates. A filter design is disclosed which utilizes fiberglass fabric that forms a tacky surface for particle entrapment. The filter has regions which cool and condense combustion solids. It is obvious from the disclosure and from the nature of the gas generating compositions that the solids produced do not form a slag and are difficult to filter.

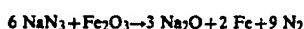
European Patent No. 0,055,904 entitled, "Azide Free Compositions for Generating Nitrogen, The Generation of Nitrogen Therefrom and Inflation of Gas Bags

Therewith" describes a filter used for particle entrapment. Oxidizers which contain no oxygen are used, and no mention of slag formation is made.

German Patent 2,004,620 teaches compositions of organic salts (aminoguanidine) of ditetrazole and azotetrazole that are oxidized using oxidizers such as barium nitrate or potassium nitrate. However, no compositions are mentioned which would lead to slag formation.

U.S. Pat. No. 3,947,300 entitled, "Fuel for Generation of Nontoxic Propellant Gases" discloses the use of alkali or alkaline earth metal azides that can be oxidized by practically any stable anhydrous oxidizing agent. The ratio of ingredients is selected to assure the formation of glass-like silicates with "as low a melting or softening point as possible" (column 2, lines 62-63 and column 4, lines 67-68). These silicates would be very difficult to filter in a high temperature system.

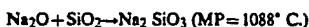
U.S. Pat. No. 4,376,002 entitled, "Multi-Ingredient Gas Generators" teaches the use of sodium azide and metal oxide ( $\text{Fe}_2\text{O}_3$ ). The metal oxide functions as an oxidizer converting sodium azide to sodium oxide and nitrogen as shown in the following equations:



OR



The sodium oxide then reacts with the Feo forming sodium ferrite or with silicon dioxide (if present) to form sodium silicate or with aluminum oxide to form sodium aluminate, as shown below:



OR



However, the above reaction products melt at temperatures well below the combustion temperature of compositions described in this invention and would, therefore, be difficult to filter.

U.S. Pat. No. 4,931,112 entitled, "Gas Generating Compositions Containing Nitrotriazalone" discloses the use of nitrotriazalone (NTO) in combination with nitrates and nitrites of alkali metals (except sodium) and the alkaline earth metals calcium, strontium or barium. However, the compositions taught in the patent are not capable of forming useful solid clinkers. For example, the two compositions given in Example 2 consist of different ratios of NTO and strontium nitrate which, upon combustion, would produce strontium oxide and strontium carbonate as fine dust since there is no low-temperature slag former present. Compositions claimed, utilizing mixtures of NTO and potassium nitrate, likewise will not form a useful solid clinker since potassium carbonate would be produced which would be a liquid at the combustion temperature and no high temperature slag former is present. The hydroxides mentioned are very unlikely to be formed because the excess carbon dioxide would convert the metal oxides to carbonates in preference to hydroxides. Even if some hydroxides were formed they would be the wrong type of slag former to promote clinker formation.

U.S. Pat. No. 4,909,549 entitled, "Composition and Process for Inflating a Safety Crash Bag" discloses the use of alkali metal salts, alkaline earth metal salts or ammonium salt of a hydrogen containing tetrazole in the range of about 20 to about 65 wt. %. The effectiveness of alkali metal compounds, at these or lower concentrations, was not known.

### SUMMARY OF THE INVENTION

The primary advantage of a new nonazide gas generant composition in accordance with the instant invention is that solid combustion products are easily filtered from the gas produced. The nonazide gas generant uses tetrazoles or tetrazole salts as the fuel and nitrogen source. The unique feature of this invention is the novel use of oxidizers and additives resulting in solid combustion products which coalesce into easily filtered slag or clinkers.

Also, the gas generant compositions comprising this invention provide a relatively high yield of gas (moles of gas per gram of gas generant) compared to conventional occupant restraint gas generants.

Another primary advantage of a preferred embodiment of this invention is that the NOx is controlled by means which are effective even though a limited amount of excess oxygen is present. This allows reduction of the CO level by the excess oxygen while, at the same time, lowering the NOx concentration to acceptable values.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

Since the ability to rapidly produce inflation gas which is relatively free of solid particulate matter is a requirement for automobile occupant restraint systems, even relatively nontoxic solids must be reduced to low levels. Almost any gas-solid mixture can be filtered to produce clean gas if a large expensive filter can be used. However, for automobile occupant restraint systems both filter size and cost must be minimized. The best way to accomplish this end is to produce solid combustion products which coalesce into large, easily filtered "clinkers" or slag.

Many combinations of ingredients can be used to improve the filtering characteristics of the combustion products. For most practical applications, however, compromises are necessary to provide the desired combination of slag forming ability, burn rate, gas production, gas quality, pellet forming characteristics, and other processing factors.

In accordance with the instant invention, several combinations of materials have been found which, produce easily filtered solid products as well as gases useful for inflation purposes. Such materials may be categorized as fuels, oxidizers, high-temperature slag formers and low-temperature slag formers. It is important that at least one material identified with each category be included in the mixture although certain materials can serve more than one of the categories as described below.

In formulating a fuel for the gas generant of an automobile occupant restraint system, it is desirable to maximize the nitrogen content of the fuel and regulate the carbon and hydrogen content thereof to moderate values. Although carbon and hydrogen may be oxidized to carbon dioxide and water, which are relatively nontoxic

gases, large amounts of heat are generated in the process.

Tetrazole compounds such as aminotetrazole, tetrazole, bitetrazole and metal salts of these compounds as well as triazole compounds such as 1,2,4-triazole-5-one or 3-nitro-1,2,4-triazole-5-one and metal salts of these compounds are especially useful fuels.

It should be noted that certain metal salts (alkaline earth metals) of these compounds can function, at least in part, as high temperature slag formers. For example, the calcium salt of tetrazole or bitetrazole forms, upon combustion, calcium oxide which would function as a high-temperature slag former. Magnesium, strontium, barium and possibly cerium salts would act in similar manner. In combination with a low-temperature slag former, a filterable slag would be formed. The alkali metal salts (lithium, sodium, potassium) could be considered, at least in part, as low-temperature slag formers since they could yield lower melting silicates or carbonates upon combustion.

Oxidizers generally supply all or most of the oxygen present in the system. In addition, however, they are the preferred method of including a high-temperature slag former into the reaction system. The alkaline earth and cerium nitrates are all oxidizers with high-temperature slag forming potential, although most of these salts are hygroscopic and are difficult to use effectively. Strontium and barium nitrates are easy to obtain in the anhydrous state and are excellent oxidizers. Alkali metal nitrates, chlorates and perchlorates are other useful oxidizers when combined with a high-temperature slag former.

Materials which function as high-temperature slag formers have melting points at, or higher, than the combustion temperature or decompose into compounds which have melting points, at or higher, than the combustion temperature. The alkaline earth oxides, hydroxides and oxalates are useful high-temperature slag formers. Magnesium carbonate and magnesium hydroxide are very useful high-temperature slag formers because they decompose before melting to form magnesium oxide which has a very high melting point (2800° C.). As mentioned above, oxidizers such as strontium nitrate are especially beneficial since they serve both as high-temperature slag former and oxidizer, thereby increasing the amount of gas produced per unit weight.

Metal salts as fuels, such as the calcium or strontium salt of 5-aminotetrazole, tetrazole, or ditetrazole are also useful high-temperature slag formers, although not as efficient as the oxidizers.

Other metal oxides having high melting points such as the oxides of titanium, zirconium and cerium are also useful high-temperature slag formers.

Materials which function as low-temperature slag formers have melting points at or below the combustion temperature or form compounds during combustion which have melting points at or below the combustion temperature. Compounds such as silicon dioxide (SiO<sub>2</sub>), boric oxide (B<sub>2</sub>O<sub>3</sub>), vanadium pentoxide (V<sub>2</sub>O<sub>5</sub>), sodium silicate (Na<sub>2</sub> SiO<sub>3</sub>), potassium silicate (K<sub>2</sub>SiO<sub>3</sub>), sodium carbonate (Na<sub>2</sub> CO<sub>3</sub>) and potassium carbonate (K<sub>2</sub>CO<sub>3</sub>) are examples of low-temperature slag formers.

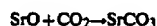
It should be noted that either the oxidizer or the fuel can act as a low-temperature slag former if it contains a suitable substance which can be converted during combustion. For example, sodium nitrate or the sodium salt of tetrazole, during the combustion reactions, can con-

vert to sodium carbonate or sodium silicate, if silicon dioxide is also present.

It is desirable to combine the fuel or oxidizer (or both) and the high temperature slag former into one ingredient, as shown in Example 1, where the strontium nitrate serves as both the oxidizer and high-temperature slag former. In this case, the strontium nitrate will yield, upon combustion, strontium oxide (SrO), which has a high melting point (2430° C.) as well as oxygen and nitrogen gases. Silicon dioxide, used as a low-temperature slag former is available in many forms ranging from very fine submicron particles to coarse ground sand with melting points from about 1500° to 1700° C. The combination of strontium oxide and silicon dioxide forms strontium silicate (SrSiO<sub>3</sub>) with a melting point of approximately 1580° C.



Strontium oxide can also react with carbon dioxide, forming strontium carbonate which melts at approximately 1500° C. at high pressure.



The extent of each of these reactions depends upon various conditions such as combustion temperature, pressure, particle size of each component, and the contact time between the various materials.

It is believed that the function of the low-temperature slag former is to melt and glue the high-temperature solid particles together. With only low-temperature residue, the material is liquid and is difficult to filter. With only high-temperature materials, finely divided particles are formed which are also difficult to filter. The objective is to produce just enough low-temperature material to induce a coherent mass or slag to form, but not enough to make a low viscosity liquid.

Set in the above context, the pyrotechnic, slag forming gas generating mixture of the present invention comprises at least one each of the following materials.

a. A fuel selected from the group of tetrazole compounds consisting of aminotetrazole, tetrazole, bitetrazole and metal salts of these compounds as well as triazole compounds and metal salts of triazole compounds.

b. An oxygen containing oxidizer compound selected from the group consisting of alkali metal, alkaline earth metal, lanthanide and ammonium nitrates and perchlorates or from the group consisting of alkali metal or alkaline earth metal chlorates or peroxides.

c. A high temperature slag forming material selected from the group consisting of alkaline earth metal or transition metal oxides, hydroxides, carbonates, oxalates, peroxides, nitrates, chlorates and perchlorates or from the group consisting of alkaline earth metal salts of tetrazoles, bitetrazoles and triazoles.

d. A low-temperature slag forming material selected from the group consisting of silicon dioxide, boric oxide and vanadium pentoxide or from the group consisting of alkali metal silicates, borates, carbonates, nitrates, perchlorates or chlorates or from the group consisting of alkali metal salts of tetrazoles, bitetrazoles and triazoles or from the group consisting of the various naturally occurring clays and talcs.

In practice, certain of the materials may be substituted or interchanged. Specifically, both the fuel and the high-temperature slag forming material may be



selected from the group consisting of alkaline earth metal salts of tetrazoles, bitetrazoles and triazoles. Both the oxygen containing oxidizer compound and high-temperature slag forming material may be comprised of one or more of the group consisting of alkaline earth metal and lanthanide nitrates, perchlorates, chlorates and peroxides. Both the fuel and the low-temperature slag forming material may comprise one or more of the group consisting of alkali metal salts of tetrazoles, bitetrazoles and triazoles. Both the oxygen containing oxidizer compound and the low-temperature slag forming material may comprise one or more of the group consisting of alkali metal nitrates, perchlorates, chlorates and peroxides.

The fuel may comprise 5-aminotetrazole which is present in a concentration of about 22 to about 36% by weight, where the oxygen containing oxidizer compound and high-temperature slag former is strontium nitrate which is present in a concentration of about 38 to about 62% by weight, and said low-temperature slag former is silicon dioxide which is present in a concentration of about 2 to about 18% by weight.

Alternatively, the fuel and high-temperature slag forming material may comprise the strontium salt of 5-aminotetrazole which is present in a concentration of about 30 to about 50% by weight, where the oxygen containing oxidizer compound is potassium nitrate which is present in a concentration of about 40 to about 60% by weight, and the low-temperature slag former is talc which is present in a concentration of about 2 to about 10% by weight. The talc may be replaced by clay.

Another combination comprises the 5-aminotetrazole which is present in a combination of about 22 to about 36% by weight, where the oxygen containing oxidizer compound is sodium nitrate which is present in a concentration of about 30 to about 50% by weight, the high-temperature slag forming material is magnesium carbonate which is present in a concentration of about 8 to about 30% by weight, and the low-temperature slag former is silicon dioxide which is present in a concentration of about 2 to about 20% by weight. Magnesium carbonate may be replaced by magnesium hydroxide.

Yet another combination comprises the potassium salt of 5-aminotetrazole which is present in a concentration of about 2 to about 30% by weight which serves in part as a fuel and in part as a low-temperature slag former and wherein 5-aminotetrazole in a concentration of about 8 to about 40% by weight also serves as a fuel, and wherein clay in a concentration of about 2 to about 10% by weight serves in part as the low-temperature slag former and wherein strontium nitrate in a concentration of about 40 to about 66% by weight serves as both the oxygen containing oxidizer and high-temperature slag former.

In another preferred embodiment, the invention comprises a pyrotechnic gas generating mixture of the type described comprising at least one material of each of the following functional groups of materials:

a fuel, an oxygen containing oxidizer compound, a chemical additive, and a low temperature slag forming material.

The fuel is selected from the group of azole compounds consisting of triazole, tetrazolone, aminotetrazole, tetrazole, bitetrazole and metal salts of these compounds. The oxygen containing oxidizer compound is selected from the group consisting of alkaline earth metal nitrates. The chemical additive is an alkali metal

salt of an inorganic acid or organic acid selected from the group consisting of carbonate, triazole, tetrazole, 5-aminotetrazole, bitetrazole, and 3-nitro-1,2,4-triazol-5-one, said chemical additive being present in said mixture in an amount sufficient to reduce the amount of toxic oxides of nitrogen from the combustion products produced by the mixture under combustion. The low-temperature slag forming material is selected from the group consisting of naturally occurring clays, talcs or silicas.

One preferred composition is one wherein the fuel comprises 5-aminotetrazole in a concentration of about 28 to about 32% by weight, the oxygen containing oxidizer compound comprises strontium nitrate in a concentration of about 50 to about 55% by weight, the chemical additive comprises potassium carbonate in a concentration of about 2 to about 10% by weight, and the low-temperature slag former comprises clay in a concentration of about 2 to about 10% by weight.

Another preferred composition is one wherein the fuel comprises 5-aminotetrazole in a concentration of about 26 to about 32% by weight, the oxygen containing oxidizer compound comprises strontium nitrate in a concentration of about 52 to about 58% by weight, the chemical additive comprises sodium tetrazole in a concentration of about 2 to about 10% by weight, and the low-temperature slag former comprises clay in a concentration of about 2 to about 10% by weight.

Still another preferred composition is one wherein the fuel comprises 5-aminotetrazole in a concentration of about 26 to about 32% by weight, the oxygen containing oxidizer compound comprises strontium nitrate in a concentration of about 52 to about 58% by weight, the chemical additive comprises the potassium salt of 5-aminotetrazole in a concentration of about 2 to about 12% by weight, and the low-temperature slag former comprises talc in a concentration of about 2 to about 16% by weight.

The invention importantly provides means of reducing the amount of the toxic gases NO<sub>x</sub> and CO in gas generant combustion products. This is accomplished by using an alkali metal salt mixed into the propellant. The primary effect of the salt is to reduce the amount of NO<sub>x</sub> but this allows formulation of the gas generant to provide an excess of oxygen, in the combustion products, which reduces the amount of carbon monoxides as well as the NO<sub>x</sub>.

The invention contemplates application of these means to any gas generant which produces NO<sub>x</sub> and carbon monoxide.

The type of alkali metal compound used is important. While all alkali metals are likely to be effective in controlling NO<sub>x</sub>, potassium is the most preferred alkali metal because of its availability, low cost and effectiveness. The alkali metal preferably should be incorporated into the propellant as part of an organic compound rather than an inorganic compound. Potassium carbonate also is effective. The preferred method of incorporating alkali metals into gas generants is as salts of organic acids. For gas generants used in automobile airbags it is advantageous to use compounds which have a high nitrogen content such as alkali metal salts of tetrazoles or triazoles. These materials serve multiple functions when incorporated into a gas generant. In addition to reducing the amount of NO<sub>x</sub> produced, these compounds serve as fuels which produce useful gases and as low temperature slag formers as described elsewhere herein.

The range of alkali metal compounds which can be effectively used in a gas generant is quite broad. As little as 2% K5 AT has been found to be effective as an additive and, in cases where the K5 AT served as the primary fuel and gas producer, up to about 45% has been used. The preferred range, however, is about 2 to about 20% and the most preferred range is from about 2 to about 12% by weight.

Regarding the chemical additive, as indicated, the organic acid salts and carbonates are effective. The salts of organic acids are most effective and are therefore preferred. The alkali metal salts of 5-aminotetrazole, tetrazole, bitetrazole and 3-nitro-1,2,4-triazole-5-one (NTO) are preferred because of their high nitrogen content. Lithium, sodium and potassium are preferred alkali metals; the invention also contemplates the use of rubidium and cesium. The most preferred alkali metal is potassium and the most preferred salt is the potassium salt of 5-aminotetrazole.

The invention is illustrated by the following representative examples.

#### EXAMPLE 1

A mixture of 5-aminotetrazole (5 AT) strontium nitrate and silicon dioxide (silica) was prepared having the following composition in percent by weight: 33.1% 5 AT, 58.9% strontium nitrate and 8% silica (Hi-sil 233). These powders were dry blended and pellets were prepared by compression molding. When ignited with a propane-oxygen torch, these pellets burned rapidly and left a coherent, well formed, solid residue.

#### EXAMPLE 2

A mixture of 5 AT, strontium nitrate and bentonite clay was prepared having the following composition in percent by weight: 33.1% 5 AT, 58.9% strontium nitrate and 8% clay. These powders were prepared and tested as in Example 1 with essentially identical results.

#### EXAMPLE 3

A mixture of 5 AT, strontium nitrate and boric oxide was prepared having the following composition in percent by weight: 33.1% 5 AT, 58.9% strontium nitrate and 8% boric oxide ( $B_2O_3$ ). These powders were dry blended and pellets were prepared by compression molding. When ignited with a propane-oxygen torch these pellets burned at a moderate rate and left a solid, partially porous residue.

#### EXAMPLE 4

A mixture of 5 AT, sodium nitrate, iron oxide and silicon dioxide was prepared having the following composition in percent by weight: 26.7% 5 AT, 39.3% sodium nitrate, 29.3% iron oxide ( $Fe_2O_3$ ) and 4.7% silicon dioxide. The iron oxide used was Mapico Red 516 Dark

and the silicon dioxide was Hi-sil 233. These powders were dry blended and pellets were formed by compression molding. When ignited with a propane-oxygen torch, the pellets burned smoothly leaving behind an expanded solid foam residue. When the pellets were burned in a Parr combustion bomb at an initial pressure of 25 atmospheres, a solid, coherent relatively hard residue was formed.

#### EXAMPLE 5

A mixture of 5 AT, sodium nitrate, strontium nitrate and silicon dioxide was prepared having the following composition in percent by weight: 33.0% 5 AT, 10.0% sodium nitrate, 49.0% strontium nitrate and 8.0% silicon dioxide (Hi-sil 233). These powders were dry-blended and pellets were formed by compression molding. When ignited with a propane-oxygen torch, the pellets burned rapidly and left a hard, solid residue.

The burning rate of this composition was found to be 0.70 inch per second at 1000 psi. The burning rate was determined by measuring the time required to burn a cylindrical pellet of known length. The pellets were compression molded in a  $\frac{1}{4}$ -in. diameter die at approximately 16,000 pounds force, and were then coated on the sides with an epoxy/titanium dioxide inhibitor which prevented burning along the sides.

#### EXAMPLE 6

A mixture of 5 AT, sodium nitrate, magnesium carbonate and silicon dioxide was prepared having the following composition in percent by weight: 29.6% 5 AT, 40.4% sodium nitrate, 25.5% magnesium carbonate and 4.5% silicon dioxide. These powders were dry-blended and pellets were formed by compression molding. When ignited with a propane-oxygen torch, the pellets burned smoothly and left a solid, hard residue.

#### EXAMPLE 7

Example 6 was repeated except that magnesium hydroxide was substituted for magnesium carbonate. Pellets were prepared and burned with essentially identical results.

#### EXAMPLE 8

A mixture of 1,2,4-triazole-5-one (TO), strontium nitrate and silicon dioxide was prepared having the following composition in percent by weight: 27.6% TO, 64.4% strontium nitrate and 8.0% silicon dioxide (Hi-sil 233). These powders were dry-blended and pellets were formed by compression molding. When ignited with a propane-oxygen torch, the pellets burned smoothly and left a solid, partially porous residue.

Table I defines the role of the various ingredients and identifies approximate ranges (in weight percent) of each ingredient for the above examples.

TABLE I

Example No.	Reactants	High Temperature Slag Former	Low Temperature Slag Former	Probable Slag Components
1.	5AT (22-36) Sr(NO <sub>3</sub> ) <sub>2</sub> SiO <sub>2</sub>	Sr(NO <sub>3</sub> ) <sub>2</sub> (38-62)	SiO <sub>2</sub> (2-18)	SrO SrCO <sub>3</sub> SrSiO <sub>3</sub>
2.	5AT (22-36) Sr(NO <sub>3</sub> ) <sub>2</sub> Clay	Sr(NO <sub>3</sub> ) <sub>2</sub> (38-62)	Clay (2-18)	SrO SrCO <sub>3</sub> SrSiO <sub>3</sub> Other silicates
3.	5AT (22-36) Sr(NO <sub>3</sub> ) <sub>2</sub> B <sub>2</sub> O <sub>3</sub>	Sr(NO <sub>3</sub> ) <sub>2</sub> (38-62)	B <sub>2</sub> O <sub>3</sub> (2-18)	SrB <sub>2</sub> O <sub>4</sub> SrB <sub>4</sub> O <sub>7</sub> SrCO <sub>3</sub>
4.	5AT (22-30)	Fe <sub>2</sub> O <sub>3</sub> (10-40)	NaNO <sub>3</sub> (30-50)	Na <sub>2</sub> SiO <sub>3</sub>

TABLE I-continued

Example No.	Reactants	High Temperature Slag Former	Low Temperature Slag Former	Probable Slag Components
	NaNO <sub>3</sub> Fe <sub>2</sub> O <sub>3</sub> SiO <sub>2</sub>		SiO <sub>2</sub> (2-10)	Na <sub>2</sub> CO <sub>3</sub> NaFeO <sub>2</sub> Fe <sub>2</sub> O <sub>3</sub> FeO
5.	5AT (22-36) NaNO <sub>3</sub> Sr(NO <sub>3</sub> ) <sub>2</sub> SiO <sub>2</sub>	Sr(NO <sub>3</sub> ) <sub>2</sub> (8-62)	NaNO <sub>3</sub> (0-42) SiO <sub>2</sub> (2-20)	Na <sub>2</sub> SiO <sub>3</sub> Na <sub>2</sub> CO <sub>3</sub> SrO SrCO <sub>3</sub> SrSiO <sub>3</sub>
6.	5AT (22-36) NaNO <sub>3</sub> MgCO <sub>3</sub> SiO <sub>2</sub>	MgCO <sub>3</sub> (8-30)	NaNO <sub>3</sub> (30-50) SiO <sub>2</sub> (2-20)	Na <sub>2</sub> SiO <sub>3</sub> Na <sub>2</sub> CO <sub>3</sub> MgSiO <sub>3</sub> MgO SiO <sub>2</sub>
7.	5AT (22-36) NaNO <sub>3</sub> Mg(OH) <sub>2</sub> SiO <sub>2</sub>	Mg(OH) <sub>2</sub> (8-30)	NaNO <sub>3</sub> (30-50) SiO <sub>2</sub> (2-20)	MgSiO <sub>3</sub> MgO SiO <sub>2</sub>
8.	TO (20-34) Sr(NO <sub>3</sub> ) <sub>2</sub> SiO <sub>2</sub>	Sr(NO <sub>3</sub> ) <sub>2</sub> (40-78)	SiO <sub>2</sub> (2-20)	SrO SrCO <sub>3</sub> SrSiO <sub>3</sub>

## EXAMPLE 9

A mixture of 5-aminotetrazole (5 AT), strontium nitrate (SrN) and bentonite clay was prepared having the following composition in percent by weight: 33.1% 5 AT, 58.9% SrN and 8.0% clay. These powders were dry blended and pellets were formed by compression molding. The pellets were burned in a Parr combustion bomb which was pressurized to 25 atmospheres pressure with nitrogen after flushing with nitrogen to remove any oxygen from the bomb. The pellets were ignited by means of a hot wire. A gas sample was removed from the bomb within 10 seconds after combustion of the gas generant in order to minimize interaction of NO<sub>x</sub> with the solid combustion products. Analysis of the gas sample showed the presence of a relatively high concentration of NO<sub>x</sub>: 2180 parts per million (ppm) of NO<sub>x</sub>.

## EXAMPLE 10

A mixture of 5 AT, SrN, bentonite clay and the potassium salt of 5 AT (K5 AT) was prepared having the following composition in percent by weight: 28.6% 5 AT, 57.4% SrN, 8.0% clay and 6.0% K5 AT. This mixture was calculated by a chemical equilibrium computer program to have a small excess of oxygen in the resulting gas mixture. The above powders were prepared and tested as described in Example 9. Two tests were performed resulting in measured NO<sub>x</sub> concentrations of 32 and 40 ppm. Example 10, by contrast with Example 9, illustrates the large reduction in NO<sub>x</sub> concentration produced by the addition of K5 AT.

## EXAMPLE 11

A mixture of 5 AT, SrN, bentonite clay and potassium carbonate was prepared having the following composition in percent by weight: 31.1% 5 AT, 55.4% SrN, 7.5% clay and 6.0% potassium carbonate. This mixture was prepared and tested as described in Example 9. Two tests were performed resulting in measured NO<sub>x</sub> concentrations of 128 and 80 ppm.

## EXAMPLE 12

A mixture of 5 AT, SrN, clay and the sodium salt of tetrazole (NaT) was prepared having the following composition in percent by weight: 30.4% 5 AT, 54.2%

SrN, 7.4% clay and 8.0% NaT. This mixture was prepared and tested as described in Example 9. Two tests were performed resulting in measured NO<sub>x</sub> concentrations of 40 and 32 ppm.

## EXAMPLE 13

A mixture of 5 AT, potassium nitrate (KN), Talc and K5 AT was prepared having the following composition in percent by weight: 25.2% 5 AT, 52.8 KN, 16.0% Talc and 6.0% K5 AT. This composition results in 2.5% by volume excess oxygen as calculated by a chemical equilibrium computer program. Small pellets of this mixture were prepared on an automatic tableting press. These pellets were tested as described in Example 9.

Two tests were performed resulting in 112 ppm NO<sub>x</sub> and 100 ppm carbon monoxide in the first test and 144 ppm NO<sub>x</sub> and 140 ppm carbon monoxide in the second test. This example illustrates that low concentrations of both NO<sub>x</sub> and carbon monoxide can be obtained by using K5 AT in combination with excess oxygen.

While the preferred embodiment of the invention has been disclosed, it should be appreciated that the invention is susceptible of modification without departing from the scope of the following claims.

I claim:

1. A pyrotechnic, gas generating mixture useful under combustion for inflating an automobile or aircraft safety crash bag, said pyrotechnic mixture comprising at least one material of each of the following functional groups of materials:

- a. A fuel selected from the group of azole compounds consisting of triazole, aminotetrazole, tetrazole, bitetrazole, and metal salts of these compounds,
- b. An oxygen containing oxidizer compound selected from the group consisting of alkaline earth metal nitrates and perchlorates, and alkali metal nitrates and perchlorates,
- c. A chemical additive that is an alkali metal salt of an inorganic acid or organic acid selected from the group consisting of carbonate, triazole, tetrazole, 5-aminotetrazole, bitetrazole, and 3-nitro-1,2,4-triazole-5-one, said chemical additive being present in said mixture in an amount sufficient to reduce the amount of toxic oxides of nitrogen from the combustion products produced by the mixture under combustion, and

d. A low-temperature slag forming material selected from the group consisting of naturally occurring clays and talcs and silica, with the proviso that said gas generating mixture lacks a high temperature slag forming material selected from the group consisting of alkaline earth metal oxides, hydroxides, carbonates, and oxalates, and with the further proviso that where the low temperature slag forming material comprises clay or silica, the pyrotechnic mixture does not in weight % contain the following: [K5 AT 2 to 30 5 AT 8 to 40 Clay 2 to 10 Sr(NO<sub>3</sub>)<sub>2</sub> 40 to 66]

5-aminotetrazole	about 22 to about 36
Clay or SiO <sub>2</sub>	about 2 to about 18
Sr(NO <sub>3</sub> ) <sub>2</sub>	about 38 to about 62
or	
5-aminotetrazole	about 22 to about 36
Sr(NO <sub>3</sub> ) <sub>2</sub>	about 8 to about 62
NaNO <sub>3</sub>	0 to about 42
SiO <sub>2</sub>	about 2 to about 18
or	
1,2,4-triazole-5-one	about 20 to about 34
Sr(NO <sub>3</sub> ) <sub>2</sub>	about 40 to about 78
SiO <sub>2</sub>	about 2 to about 20.

2. The composition of claim 1 wherein the fuel comprises 5-aminotetrazole which is present in a concentration of about 28 to about 32% by weight, said oxygen containing oxidizer compound comprises strontium nitrate which is present in a concentration of about 50 to about 55% by weight, said chemical additive comprises potassium carbonate which is present in a concentration of about 2 to about 10% by weight, and said low-temperature slag former comprises clay which is present in a concentration of about 2 to about 10% by weight.

3. The composition of claim 1 wherein the fuel comprises 5-aminotetrazole which is present in a concentration of about 26 to about 32% by weight, said oxygen containing oxidizer compound comprises strontium nitrate which is present in a concentration of about 52 to about 58% by weight, said chemical additive comprises sodium tetrazole which is present in a concentration of about 2 to about 10% by weight, and said low-temperature slag former comprises clay which is present in a concentration of about 2 to about 10% by weight.

4. The composition of claim 1 wherein the fuel comprises 5-aminotetrazole which is present in a concentration of about 26 to about 32% by weight, said oxygen containing oxidizer compound comprises strontium nitrate which is present in a concentration of about 52 to about 58% by weight, said chemical additive comprises the potassium salt of 5-aminotetrazole which is present in a concentration of about 2 to about 12% by weight, and said low-temperature slag former comprises talc which is present in a concentration of about 2 to about 16% by weight.

5. The composition of claim 1 wherein the chemical additive is the alkali metal salt of 5-aminotetrazole.

6. The composition of claim 1 wherein the chemical additive is the alkali metal salt of tetrazole.

7. The composition of claim 1 where the chemical additive is the alkali metal salt of bitetrazole.

8. The composition of claim 1 wherein the chemical additive is the alkali metal salt of 3-nitro-1,2,4-triazol-5-one.

9. The composition of claim 1 wherein the chemical additive is the potassium, sodium or lithium salt of 5-aminotetrazole.

10. The composition of claim 1 wherein the chemical additive is the potassium, sodium or lithium salt of the tetrazole.

11. The composition of claim 1 wherein the chemical additive is the potassium, sodium or lithium salt of 3-nitro-1,2,4-triazol-5-one.

12. The composition of claim 1 wherein the chemical additive is present in a concentration of about 2% to about 45% by weight.

13. The composition of claim 1 wherein the chemical additive is an alkali metal carbonate.

14. The composition of claim 1 wherein the chemical additive is potassium carbonate.

15. A method of reducing or eliminating toxic oxides of nitrogen from the combustion of a gas generating mixture comprising fuel, oxidizer and slag forming material according to claim 1 comprising the step of including a chemical additive in said gas generating mixture comprising an alkali metal salt of an inorganic acid or organic acid selected from the group consisting of carbonate and azole.

16. The method of claim 15 wherein the chemical additive is the alkali metal salt of 5-aminotetrazole.

17. The method of claim 15 wherein the chemical additive is the alkali metal salt of tetrazole.

18. The method of claim 15 where the chemical additive is the alkali metal salt of bitetrazole.

19. The method of claim 15 wherein the chemical additive is the alkali metal salt of 3-nitro-1,2,4-triazol-5-one.

20. The method of claim 15 wherein the chemical additive is the potassium, sodium or lithium salt of 5-aminotetrazole.

21. The method of claim 15 wherein the chemical additive is the potassium, sodium or lithium salt of the tetrazole.

22. The method of claim 15 wherein the chemical additive is the potassium, sodium or lithium salt of 3-nitro-1,2,4-triazol-5-one.

23. The method of claim 15 wherein the chemical additive is present in a concentration of about 2% to about 45% by weight.

24. The method of claim 15 wherein the chemical additive is an alkali metal carbonate.

25. The method of claim 15 wherein the chemical additive is potassium carbonate.

\* \* \* \* \*

UNITED STATES PATENT AND TRADEMARK OFFICE  
CERTIFICATE OF CORRECTION

PATENT NO. : 5,139,588  
DATED : August 18, 1992  
INVENTOR(S) : Donald R. Poole

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Col. 11, Table I, in Example No. 4, under the column entitled "Low Temperature Slag Former", "SiO<sub>2</sub> (2-10)" should be --SiO<sub>2</sub> (2-20)--.

Col. 13, line 11, CLAIM 1, "[K5 AT 2 to 30 5 AT 8 to 40 Clay 2 to 10 Sr(NO<sub>3</sub>)<sub>2</sub> 40 to 66]" should be deleted in its entirety.

Signed and Sealed this  
Fifth Day of October, 1993

Attest:



BRUCE LEHMAN

Attesting Officer

Commissioner of Patents and Trademarks

- [54] **GAS GENERATING COMPOSITIONS  
CONTAINING AMMONIUM SULFATE  
ACCELERATION FORCE DESENSITIZER**
- [75] Inventors: Eugene J. Pacanowsky, Elkton, Md.;  
Eugene A. Martino, Newark, Del.
- [73] Assignee: Thiokol Corporation, Newtown, Pa.
- [22] Filed: Jan. 27, 1972
- [21] Appl. No.: 221,169

- [52] U.S. Cl. .... 149/19.5; 149/19.6;  
149/19.9; 149/19.91; 149/76
- [51] Int. Cl.<sup>2</sup> ..... C06B 45/10
- [58] Field of Search ..... 149/19, 76, 85, 19.6,  
149/19.9, 19.5, 19.91

- [56] **References Cited**  
**UNITED STATES PATENTS**
- 2,411,070 11/1946 Van Karner ..... 149/85 X

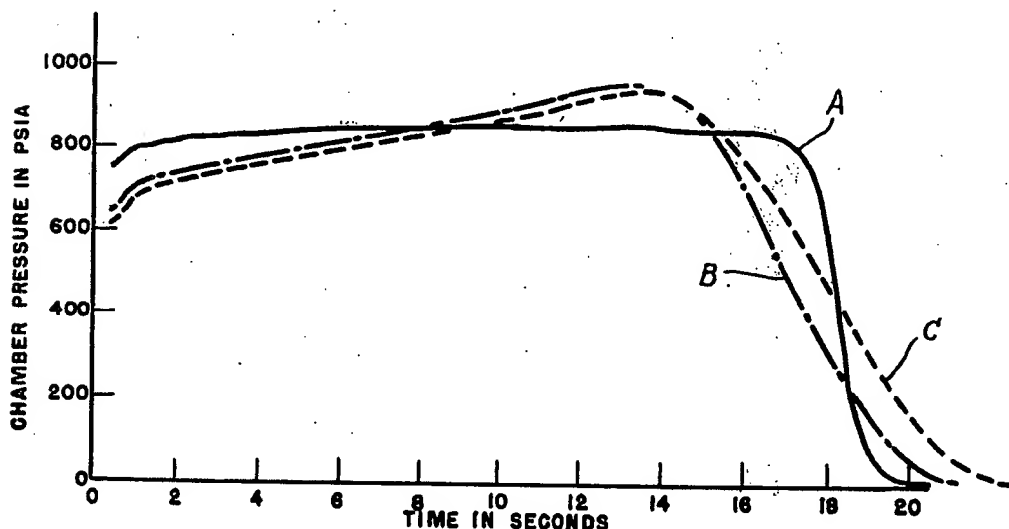
- 3,147,160 9/1964 McCrone ..... 149/76 X
- 3,203,842 8/1965 Godfrey ..... 149/19
- 3,214,304 10/1965 Vriesen ..... 149/19
- 3,467,558 9/1969 Wernette et al. .... 149/85 X
- 3,476,622 11/1969 Harada et al. .... 149/19
- 3,734,789 5/1973 Moy et al. .... 149/19.6 X
- 3,846,195 11/1974 Zimmerman et al. .... 149/19.6 X

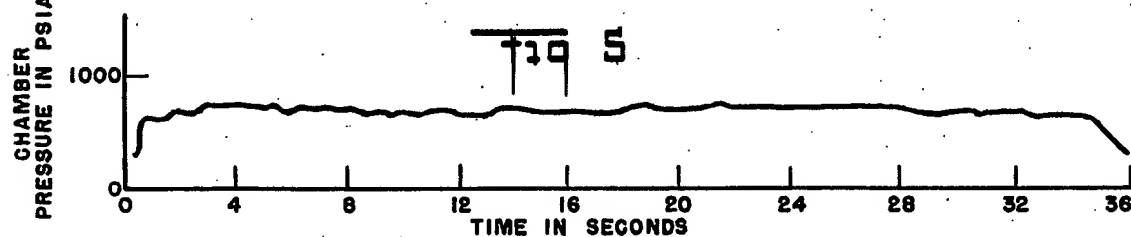
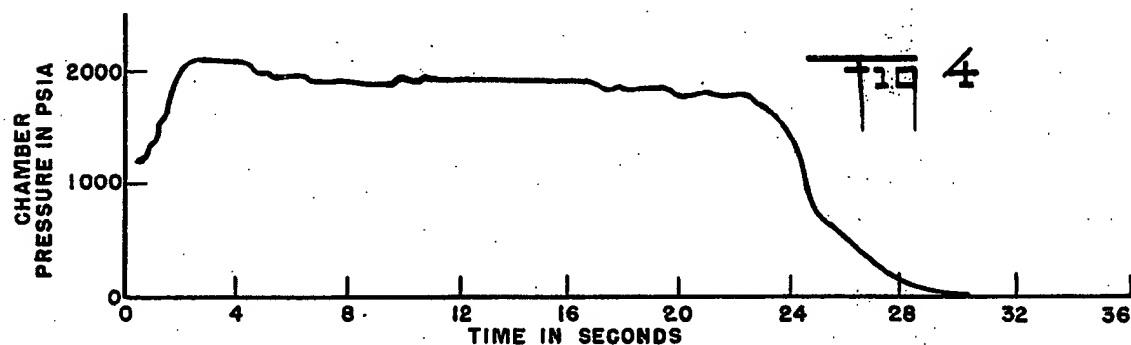
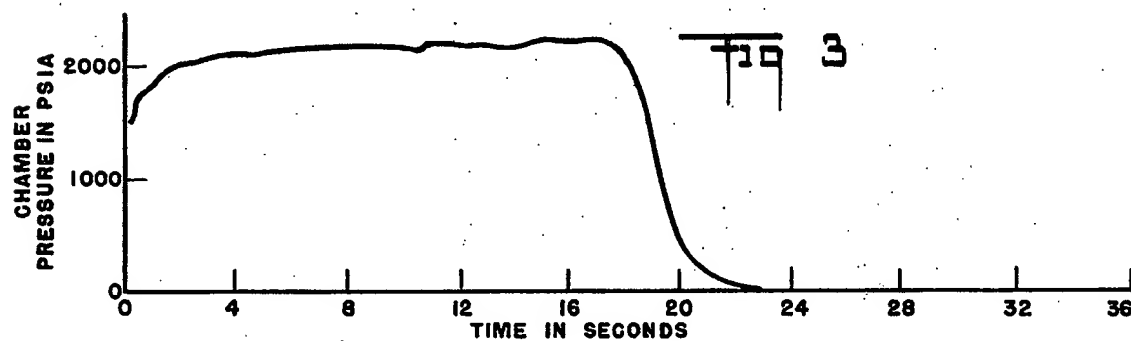
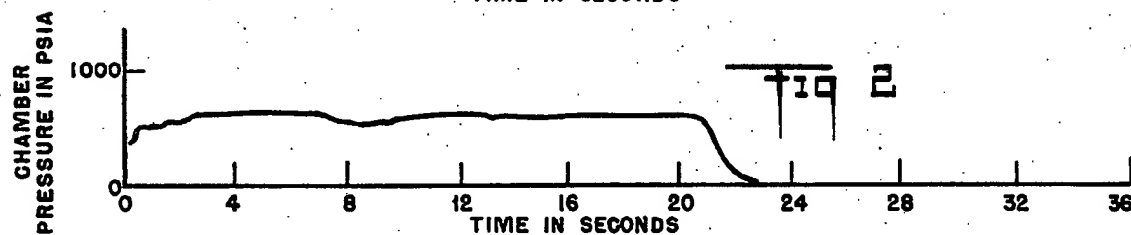
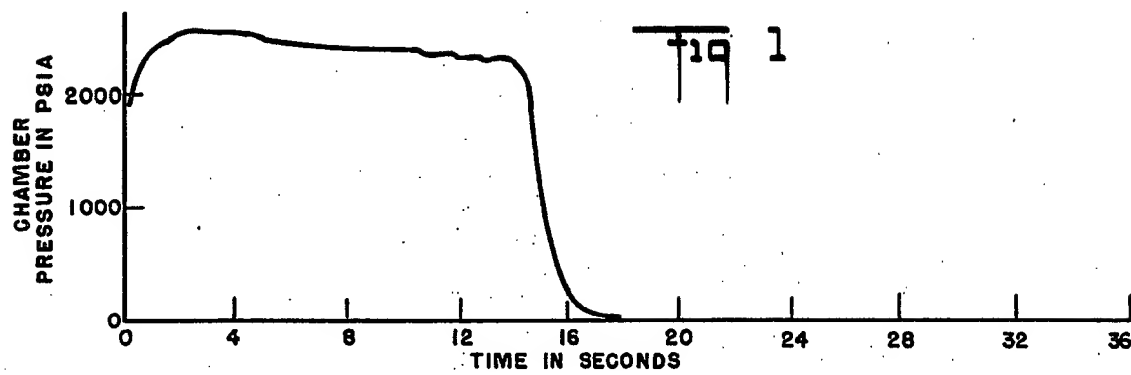
Primary Examiner—Edward A. Miller

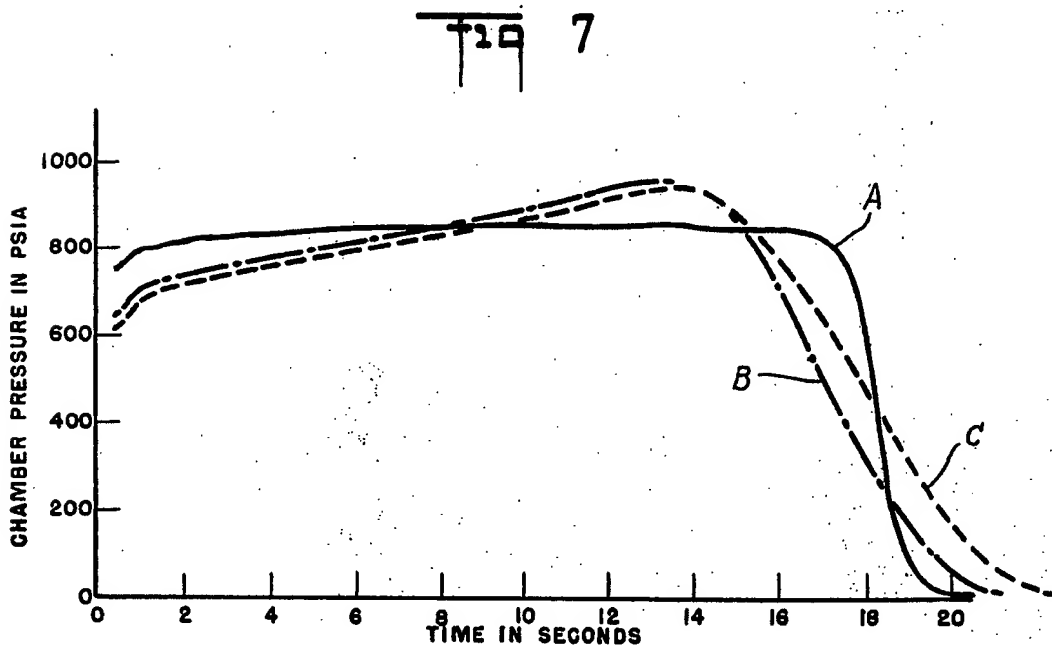
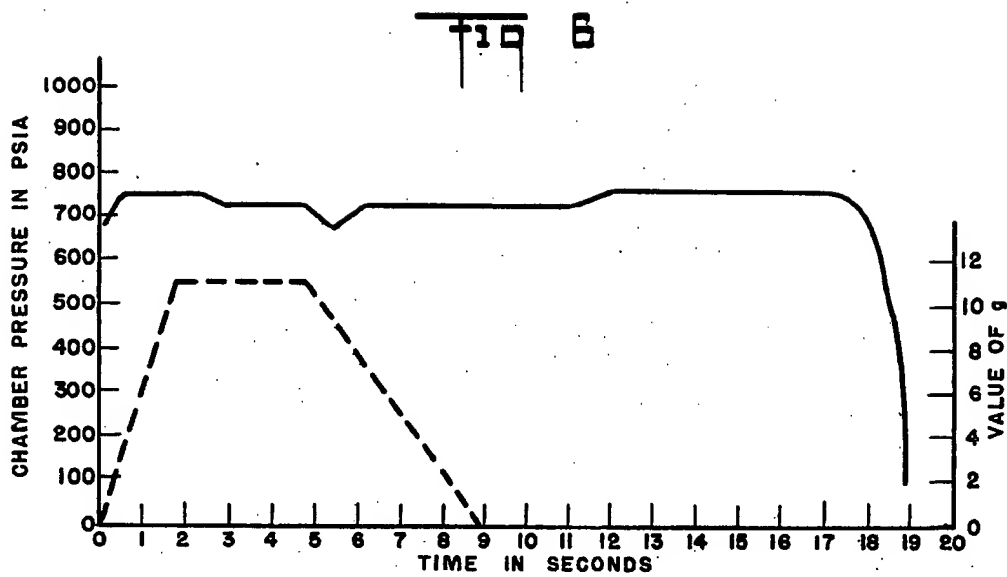
## [57] ABSTRACT

A gas generating composition having decreased sensitivity to compressive acceleration forces. The composition comprises an intimate mixture of ammonium perchlorate oxidizer and elastomeric fuel binder in such proportions as to provide a burning rate of 0.05 to 0.3 inches per second at a pressure of 1000 p.s.i.a. and has incorporated therein 5 to 35% of ammonium sulfate as an acceleration force desensitizing agent.

11 Claims, 7 Drawing Figures









# **GAS GENERATING COMPOSITIONS CONTAINING AMMONIUM SULFATE ACCELERATION FORCE DESENSITIZER**

This invention relates to gas generators, and more particularly, to gas generating compositions that have a decreased sensitivity to the effects of acceleration forces.

Gas generators are portable, compact primary power units, often referred to as auxiliary power units, containing gas generating compositions which, when ignited, generate gases under pressure that can be used as motive power for a variety of mechanical applications. The gas generating compositions used in such gas generators are solid compositions that support combustion and produce gases in the absence of atmospheric air. The gases thus produced can be used, for example, to pressurize a fluid or drive a turbine to produce mechanical or electrical energy, to actuate safety brakes on vehicles or to start various mechanical devices. Such gas generating devices are capable of producing a rather substantial amount of power per unit of weight as compared to conventional gas or oil energized generators. Because of their high power to weight ratio, these devices are especially suited for use in aerospace and missile applications.

In some respects, gas generating compositions are similar to solid propellant compositions used to power rockets and missiles. Like missile propellant compositions, gas generating compositions must fulfill certain stringent physical requirements to be acceptable. For example, like missile propellant compositions, gas generating compositions should be ballistically stable after prolonged storage at extreme temperatures ranging from as high as 180° F. to as low as -80° F. In addition, particularly for aerospace and missile applications, the compositions must be readily ignitable within these same temperature ranges. Furthermore, the compositions must be relatively insensitive to shock, have substantial elasticity to minimize gaps or voids and must burn evenly and consistently. Finally, both types of compositions consist essentially of an oxidizer and a combustible fuel binder, ordinarily supplemented by small quantities of various special purpose additives. It should be noted that the additives are optional components of the compositions and will vary in type and content from composition to composition.

While as indicated above there are several areas of similarity between gas generating compositions and propellant compositions, the differences between the two types of compositions are quite important. Thus gas generating compositions, unlike propellant compositions, should have a relatively slow burning rate and burn at relatively low flame temperatures. Another requirement is that the combustion of the gas generating compositions should desirably generate essentially particle free gases that are relatively non-erosive. In addition, ideally the burning rate of the gas generating composition should be as independent as possible of the temperatures and pressures produced during combustion. The need for these special requirements arises because of the different purposes for which the two compositions are designed. For example, the combustion of missile propellants produces exceedingly high flame temperatures, often in excess of 4000° C. These high flame temperatures are destructive to parts fabricated of the common commercial metal alloys such as

the stainless steels over any sustained period of time. In fact, prolonged exposure to these higher temperatures produces deterioration of many of the specially formulated so-called "heat-resistant alloys." The erosion and corrosion of the metal missile parts that occurs during combustion is of little importance in missiles since they are designed as expendable "one-shot" pieces of hardware. Similarly, the presence of erosive or corrosive combustion products as evidenced by smoky combustion gases causes little concern.

In contrast, the effect of high combustion temperatures and erosive solid particles in the combustion gases on gas turbine-type engines is more serious. For example, the solid particles not only erode the metal parts they contact but they can clog the movable engine parts of engines for which they are used as a source of motive fluid, thus impairing engine performance as well as causing engine failure. This increases maintenance costs and reduces useful engine life. Since power generating devices are designed for long term use, dependability and long life are important for commercial acceptance. Thus, the typical missile propellant composition of the prior art has little value as a gas generating composition.

Typical gas generator compositions have burning rates of the order of 0.05 to 0.3 inches per second at a pressure of 1000 p.s.i.a. and produce gases having temperatures below about 2500° F. The attainment of relatively low gas temperatures can be promoted by incorporating in the gas generating composition any of various known coolants.

In general, gas generating compositions have the desirable characteristic of producing a substantially horizontal pressure-time trace, that is to say, the combustion chamber pressure remains substantially constant for almost the entire period between ignition and burn-out. However, in certain applications the gas generator is subjected to accelerative forces, and it has been found that such accelerative forces have a significant effect upon the burning characteristics of the gas generating compositions. More particularly, an accelerative compressive force exerted on the gas generating composition may cause the gas pressure to increase significantly during the burning period. For example, a compressive force of as little as 5 g to 10 g may produce a progressive pressure increase of as much as 10% to 40% or more between ignition and burn-out. Such a pressure increase in the combustion chamber of the gas generator is highly undesirable since it produces a non-uniform flow of motive gas. It has been found that the known burning rate modifiers have little, if any, effect in preventing this pressure increase.

It is accordingly an object of the present invention to provide a gas generating composition which is substantially insensitive to the effects of accelerative forces. It is another object of the invention to provide a gas generating composition which generates a substantially constant combustion chamber pressure even when subjected to compressive accelerative forces of as much as 150 g or more. Other objects of the invention will be in part obvious and in part pointed out hereafter.

The present invention is predicated on the discovery that the burning rate of gas generating compositions can be rendered substantially insensitive to the effects of compressive accelerative forces by incorporating in the composition a suitable amount of ammonium sulfate. In fact in some cases compositions containing

ammonium sulfate exhibit a slightly progressive decrease in combustion chamber pressure when subjected to compressive accelerative forces. Moreover, ammonium sulfate also shows a coolant effect, i.e., it tends to reduce to some extent the flame temperature of the gas generating composition in which it is incorporated, thus making it unnecessary in some cases to add a separate coolant to the composition.

The amount of ammonium sulfate to be used in the composition depends upon such factors as the nature of the oxidizer and fuel binder used and the magnitude of the accelerative force to which the generator is to be subjected. In most cases the desired effect can be attained by using from 5% to 35% by weight of the ammonium sulfate, based on the total weight of the gas generator composition. The preferred proportion of ammonium sulfate is from 15% to 25% by weight.

The finely divided oxidizers used in the present compositions are perchlorate salts such as ammonium perchlorate and the alkali metal and alkaline earth metal perchlorates. The preferred oxidizer is ammonium perchlorate since it minimizes solid residues. However, salts such as sodium, potassium, calcium and barium perchlorates may also be used. As is known in the art, the oxidizer may be used in multi-modal form, that is, a mixture of two or more different particle sizes of the oxidizer may advantageously be used.

In general, any of the fuel binders known to be useful in gas generator compositions may be employed in preparing the present composition. As is known in the art, gas generator compositions are ordinarily formulated by thoroughly mixing with the oxidizer and special purpose additives a liquid polymer and curing agent capable of curing the polymer to solid form, and then heating the mixture to convert the liquid polymer to solid, usually elastomeric form. The liquid polymer forming the basis of the fuel binder may be, for example, a linear polyester with functional groups such as carboxyl or hydroxyl groups, a hydroxyl- or carboxyl-terminated linear aliphatic hydrocarbon, a polyurethane prepolymer, a polythiopolymercaptan, a butadiene-acrylic acid copolymer, a butadiene-acrylonitrile-acrylic acid copolymer, a butadiene-vinylpyridine copolymer, a polyacrylate, a polycarbonate or blends of said liquid polymers. The polyurethanes may be plasticized with nitro or nitrate esters, e.g., diethylene glycol dinitrate, trimethylolethane trinitrate and the like. Double base systems may also be used as the binder or binder-oxidizer, e.g., nitrocellulose, nitroglycerine or cellulose acetate, which can be plasticized with nitro compounds, nitrate esters or triacetin. In general, the oxygenated fuel binders, e.g., the polyesters give somewhat lower burning rates.

The polyesters having functional terminals used as fuel binders in the present compositions may be prepared in known manner by reacting dicarboxylic acids with diols under temperature and pressure conditions known in the art. Typical dicarboxylic acids useful in preparing the polyesters include oxalic, succinic, adipic, sebacic, maleic and fumaric acids and others, as well as mixtures of these acids. The diols used may include ethylene glycol, diethylene glycol, triethylene glycol, propylene glycol, polybutylene and polypropylene glycols, alkane diols, castor oil and the like. Minor amounts of polybasic acids such as itaconic and polyhydric alcohols such as glycerols, sorbitols and pentaerythritol may be included in the reaction mixture. The

liquid polyesters preferably have a molecular weight of 500 to 5000.

The carboxyl-terminated aliphatic hydrocarbons may be carboxyl-terminated butadiene polymers prepared as described in Berenbaum U.S. Pat. No. 3,235,589 and may have a molecular weight within the range 500 to 10,000. The carboxyl-terminated acrylobutadiene copolymers may be prepared as disclosed in Lowrey et al. U.S. Pat. No. 3,595,717 and may have molecular weights within the range 1000 to 7000. The liquid polyurethane prepolymers may be prepared in known manner by reacting diisocyanates and polyisocyanates with carboxyl-terminated polyesters or polyethers, or known commercial types of liquid polyurethane polymers may be used. The liquid polythiopolymercaptans may be prepared as disclosed in U.S. Pat. No. 2,466,963 and may have molecular weights in the range 1000 to 5000. The liquid prepolymers used as fuel binders are cured according to curing techniques well known in the resin art using polymerization catalysts, curing agents or accelerators commonly used. For example, the polyesters may be cured at temperatures ranging from 80° to 180° F. using the usual curing agents such as polyepoxides, polyamines and the like. Similarly the polyurethane prepolymers can be cured at temperatures varying between ambient and 250° F. when treated with curing agents such as polyols. The carboxyl-terminated hydrocarbon polymers and acrylobutadiene copolymers such as the acrylic acid butadiene copolymers can be conveniently cured with polyepoxides, e.g., trifunctional epoxide resins based on p-amino-phenol, aziridines and epoxide aziridines in known manner. Small amounts of curing catalysts of the metal salt type, e.g., iron, chromium, or stannous salts of linoleic or 2-ethyl hexanoic acid may be used in conjunction with the polyepoxide curing agent. The liquid polythiopolymercaptans can be cured with various oxidizing agents as disclosed in U.S. Pat. No. 2,466,963.

In addition to the perchlorate oxidizer, cured elastomeric fuel binder and ammonium sulfate desensitizer, the present compositions may contain a variety of special purpose additives. These may include plasticizers such as alkyl phthalates and the like, darkening agents such as carbon black and various combustion catalysts and/or burning rate modifiers and/or coolants such as, for example, ammonium dichromate, dihydroglyoxine, oxamide, cobalt dicyclopentadiene, ferric and cobalt acetate and the like. The special purpose additives are optional components of the present compositions and may be present in the composition to the extent of say 0% to 10% by weight of the composition.

In general, the present compositions comprise:

1. From 40% to 70% by weight of finely divided inorganic perchlorate oxidizer, preferably ammonium perchlorate,
2. From 10% to 35% of elastomeric combustible fuel binder,
3. From 5% to 35% of an acceleration force desensitizer which is ammonium sulfate, and
4. From 0 to 10% by weight of the special purpose additives referred to above.

In preparing the present compositions the perchlorate oxidizer in finely divided form and the liquid fuel binder and curing agent therefor, and the ammonium sulfate desensitizer also in finely divided form are placed in a mixer together with the special purpose additives if required and thoroughly mixed. The mixing

5

time required to achieve the desired degree of uniformity varies according to the batch size and properties of the ingredients used such as viscosity of the fuel binder prepolymer, the nature of the curing agent, and particle size of the oxidizer and desensitizer. Ordinarily at least 30 minutes is required to achieve the desired uniformity. The mixed composition is introduced into a suitable casing, usually having a nozzle outlet, and is cured in situ in the casing at a temperature which in most cases falls in the range 80° to 200° F. The particular curing temperatures required to cure the liquid prepolymers described above is known in the art.

In order to illustrate further the nature of the present invention the following Examples are given. In these Examples the components of the composition are given in parts by weight. The compositions were incorporated in gas-generating casings as described above and tested to determine their burning characteristics when subjected to several different accelerator forces. The pressure traces obtained with the compositions are illustrated in FIGS. 1 to 5 of the accompanying drawing, the several FIGURES of the drawing being identified in the Examples.

#### EXAMPLE 1

A gas generating composition was prepared in the manner described above containing the following ingredients in the indicated proportions:

Ingredient	Parts by Weight
Carboxyl-terminated hydrocarbon polymer (average molecular weight about 4000) - HC 434	22.73
Curing Agent - tri-glycidyl ether of p-aminophenol - (ERL-0500) containing a small amount of curing catalyst	1.17
Carbon Black (Thermax)	0.10
Ammonium Sulfate (Average particle size - 190 microns)	16.00
Ammonium Perchlorate (Average size - 200 microns)	48.00
Ammonium Perchlorate (Average size - 12 microns)	12.00

The foregoing composition was cured for 72 hours at 150° F.

Gas generators containing the foregoing composition were tested at compressive accelerative forces of 18 g's and 137 g's with the results shown in FIGS. 1 to 3 of the drawings. FIG. 1 shows the pressure trace for the generator tested at 18 g's. It will be noted that after an initial pressure surge at the time of ignition followed by a sharp pressure drop the pressure leveled off at about 2500 p.s.i.a. and decreased slightly as the propellant burned. This contrasts with pressure traces for gas generator compositions which do not contain the ammonium sulfate desensitizer which, when subjected to an accelerative force of this magnitude, commonly show a progressive increase in pressure during most of the burning period between ignition and burn-out.

FIG. 2 shows the pressure trace for a gas generator tested at a compressive accelerative force of 137 g's. In this test the gas generator nozzle had a larger orifice than the generator of Example 1 and thus the pressure was about 600 p.s.i.a. FIG. 2 shows that even at this relatively high g level the pressure remained substantially constant throughout the burning period.

FIG. 3 shows the pressure trace for a third gas generator tested at 137 g's and having a nozzle orifice of such size that the pressure was of the order of 2100 p.s.i.a.

6

While FIG. 3 shows a slight increase in pressure during the burning period, the pressure trace is very nearly horizontal.

#### EXAMPLE 2

Gas generators were made in the manner described above incorporating gas generating compositions having the following formulation of ingredients in parts by weight:

Ingredient	Parts by Weight
Carboxyl-terminated hydrocarbon polymer (average molecular weight about 4000) HC-434	22.73
Curing Agent - triglycidyl ether of p-aminophenol - (ERL-0500) containing a small amount of curing catalyst	1.17
Carbon Black (Thermax)	0.10
Ammonium Sulfate (Average particle size - 190 microns)	21.00
Ammonium Perchlorate (Average size - 200 microns)	44.00
Ammonium Perchlorate (Average size - 12 microns)	11.00

Gas generators containing the foregoing compositions were tested at compressive accelerative forces of 17 g's and 137 g's and the pressure traces obtained are shown in FIGS. 4 and 5 of the drawing. FIG. 4 shows that for the main part of the burning period the pressure decreased from about 2100 p.s.i.a. to about 1800 p.s.i.a. FIG. 5 shows that the gas generator tested at 137 g's (using a nozzle having a somewhat larger orifice) exhibited a pressure trace which remained substantially constant at about 800 p.s.i.a. for most of the burning period.

#### EXAMPLE 3

A gas generator was made in the manner described above having a gas generating composition of the following formulation:

Ingredient	Parts by Weight
Diethylene glycol adipate polyester Molecular weight 2000	26.05
Curing Agent - triglycidyl ether of p-aminophenol	3.75
Carbon black - (Thermax)	0.10
Iron octoate	0.15
Ammonium sulfate (Average particle size - 190 microns)	19.0
Ammonium perchlorate (Average size - 200 microns)	35.7
Ammonium perchlorate (Average size - 12 microns)	15.3

A gas generator containing the foregoing composition was tested at a varying compressive accelerative force is indicated in FIG. 6. More particularly, the accelerative force was increased at a uniform rate during the first 1.7 seconds to 11 g, maintained at 11 g for about 3 seconds and then reduced to zero over a period of about 4 seconds.

The pressure trace for this composition shows that the chamber pressure remained substantially constant between ignition and burn-out. During the period when the g value was increasing the chamber pressure rose to about 750 p.s.i.a. During the period of constant g value the chamber pressure actually dropped a small amount to about 720 p.s.i.a. After the g value had been reduced

7

to zero the chamber pressure again attained a value of about 750 p.s.i.a. The significant point in relation to the trace is that increase in accelerative force did not produce an increase in chamber pressure.

#### EXAMPLE 4

This Example illustrates the manner in which chamber pressure increases when a gas generating composition is used that contains a conventional coolant rather than the acceleration desensitizer of the present invention. A gas generator was made having a gas generating composition as follows:

Ingredient	Parts by Weight
Carboxyl-terminated hydrocarbon (average molecular weight about 4000)	18.75
Curing agent - triglycidyl ether of p-aminophenol	1.0
Dihydroxyglyoxine	27.0
Oxamide	5.0
Carbon black (Thermax)	0.25
Ammonium perchlorate (Average particle size - 190 microns)	43.2
Ammonium perchlorate (Average particle size - 12 microns)	4.8

Gas generators containing the foregoing composition were tested at zero g, 11 g and 15.5 g with the results shown in FIG. 7. In FIG. 7, curve A is the pressure trace for zero g, curve B is the pressure trace for 11 g and curve C is the pressure trace for 15.5 g. It will be noted that at zero g, ignoring the pressure variations during the first second after ignition, the pressure trace for most of the period between ignition and burn out remained fairly constant. On the other hand, at 11 g and 15.5 g the pressure increased during this same period from about 700 p.s.i.a. to about 950 p.s.i.a.

It should also be noted that curves B and C show a relatively slow tapering off of chamber pressure during the latter part of the burning period rather than the relatively sharp pressure drop of curve A. This gradual decrease in chamber pressure during the latter part of the burning period is an undesirable characteristic in a gas generating composition.

From the foregoing description and Examples it should be apparent that the present invention provides gas generator compositions which because of the presence of the ammonium sulfate acceleration force desensitizer therein burn with a substantially horizontal pressure trace and avoid the undesired progressive increase in pressure characteristic of the previously proposed gas generator compositions when subjected to large acceleration forces. As pointed out above, the added ammonium sulfate also appears to operate as a coolant and thus makes it possible to obtain a gas generating composition with a relatively low flame temperature without any added coolant or with only a minor amount of such added coolant.

It is, of course, to be understood that the foregoing Examples are intended to be illustrative only and that numerous changes can be made in the proportions, ingredients and conditions disclosed without departing from the spirit of the invention as defined in the appended claims.

We claim:

8

1. A solid combustible gas generating composition having a decreased sensitivity to acceleration forces comprising an intimate mixture of 40% to 70% by weight of finely divided inorganic perchlorate oxidizer, 10% to 35% by weight of an elastomeric combustible binder selected from epoxide cured polyester and epoxide cured hydrocarbon polymers and 5 to 35% of an acceleration force desensitizer which is ammonium sulfate.
2. A composition according to claim 1 wherein said binder is an epoxide-cured condensation polymer of adipic acid and diethylene glycol.
3. A composition according to claim 1 wherein said binder is an epoxide-cured copolymer of acrylic acid and butadiene.
4. A composition according to claim 1 wherein said binder is an epoxide-cured copolymer of acrylonitrile, butadiene and acrylic acid.
5. A composition according to claim 1 wherein said binder is an epoxide-cured carboxyl-terminated hydrocarbon polymer.
6. A composition according to claim 1 wherein said oxidizer is ammonium perchlorate.
7. A solid combustible gas generating composition having a burning rate of 0.05 to 0.3 inches/second at 1000 p.s.i. and a decreased sensitivity to acceleration forces, said composition comprising an intimate mixture of combustible, oxygen-containing, organic binder selected from epoxide cured polyester and epoxide cured hydrocarbon polymers, a quantity of finely divided inorganic perchlorate oxidizer sufficient to effect substantially complete combustion of said binder when said composition is ignited and from 5% to 35% by weight of said composition of an accelerating force desensitizer which is ammonium sulfate.
8. A solid combustible gas generating composition having a decreased sensitivity to acceleration forces consisting essentially of an intimate mixture of 40 to 70% by weight of finely divided ammonium perchlorate, 10 to 35% by weight of an elastomeric combustible fuel binder selected from epoxide cured polyester and epoxide cured hydrocarbon polymers, 5 to 35% of an acceleration force desensitizer which is ammonium sulfate and 0 to 10% by weight of one or more propellant additives.
9. A gas generating composition according to claim 8 wherein the ammonium sulfate is present to the extent of 15% to 25% by weight of said composition.
10. A solid combustible gas generating composition comprising an intimate mixture of 40% to 70% by weight of finely divided inorganic perchlorate oxidizer, 10% to 35% by weight of an elastomeric combustible binder selected from epoxide cured polyester and epoxide cured hydrocarbon polymers and 5 to 35% by weight of ammonium sulfate.
11. A solid combustible gas generating composition having a burning rate of 0.05 to 0.3 inches/second at 1000 p.s.i., said composition comprising an intimate mixture of combustible, oxygen-containing, organic binder selected from epoxide cured polyester and epoxide cured hydrocarbon polymers, a quantity of finely divided inorganic perchlorate oxidizer sufficient to effect substantially complete combustion of said binder when said composition is ignited and from 5% to 35% by weight of said composition of ammonium sulfate.

\* \* \* \* \*

## **Appendix J**

**Request For Reconsideration Filed  
12/26/06**

IN THE UNITED STATES PATENT  
AND TRADEMARK OFFICE

Group Art Unit 3643  
Examiner Jeffrey L. Gellner

**REQUEST FOR RECONSIDERATION**

SEAN P. BURNS, et al.  
Serial No. 09/638,606  
Filed August 15, 2000

For: SELECTIVE NON-CATALYTIC REDUCTION  
(SNCR) OF TOXIC GASEOUS EFFLUENTS  
IN AIRBAG INFLATORS /

December 26, 2006

Commissioner For Patents  
Alexandria, Virginia 22313

Sir:

Responsive to the office action dated September 25, 2006, Applicants' response is as follows:

The present status of the claims is presented directly below.

Remarks follow this status of the claims.

**STATUS OF THE CLAIMS**

1. (cancelled)
2. (cancelled)
3. (cancelled)
4. (cancelled)
5. (cancelled)
6. (cancelled)
7. (cancelled)
8. (cancelled)
9. (cancelled)
10. (cancelled)
11. (cancelled)
12. (cancelled)
13. (cancelled)
14. (cancelled)
15. (cancelled)
16. (cancelled)
17. (cancelled)
18. (cancelled)
19. (withdrawn) A vehicle occupant restraint system of Claim 3 wherein:  
said selective non-catalytic reducing compound is urea ( $\text{H}_2\text{NCONH}_2$ ).
20. (withdrawn) A vehicle occupant restraint system of Claim 3 wherein:  
said selective non-catalytic reducing compound is cyanuric acid ( $\text{HNCO}$ )<sub>3</sub>).
21. (previously presented) A vehicle occupant restraint system comprising:

an inflatable air bag;  
a gas generator for inflating said air bag;  
a nitrogen-containing gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and  
a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds,  
wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

22. (cancelled)

23. (previously presented) A vehicle occupant restraint system comprising:

an inflatable air bag;  
a gas generator for inflating said air bag;  
a nitrogen-containing nonazide gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and  
a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds,  
wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced



upon combustion of said gas generant composition.

24. (cancelled)

25. (previously presented) A vehicle occupant restraint system comprising:

an inflatable air bag;

a gas generator for inflating said air bag;

a gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and

a selective non-catalytic reducing compound proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts and amine-containing compounds,

wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

26. (cancelled)

27. (previously presented) A vehicle occupant restraint system comprising:

an inflatable air bag;

a gas generator for inflating said air bag;

a gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and

a selective non-catalytic reducing compound placed proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds,

wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

28. (cancelled)

29. (previously presented) A vehicle occupant restraint system comprising:

an inflatable air bag;

a gas generator for inflating said air bag;

a nonazide gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and

a selective non-catalytic reducing compound placed proximate to, separate from, and interspersed about the gas generant composition within said gas generator, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds,

wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide and/or nitrogen dioxide produced upon combustion of said gas generant composition.

30. (cancelled)

31. (previously presented) A vehicle occupant restraint system comprising:

an inflatable air bag;

a gas generator for inflating said air bag;

a nitrogen-containing gas generant composition located within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and

a selective non-catalytic reducing compound placed proximate to and

interspersed about said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts,

wherein at least one mol of the selective non-catalytic reducing compound is added per mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

32. (cancelled)

33. (cancelled)

34. (previously presented) A vehicle occupant restraint system comprising:

an inflatable air bag;

a gas generator for inflating said air bag;

a nitrogen-containing gas generant composition within said gas generator that forms nitrogen oxide and/or nitrogen dioxide upon combustion thereof; and

a selective non-catalytic reducing compound placed within said gas generator in heterogeneous relation to said gas generant composition, wherein said selective non-catalytic reducing compound is selected from the group consisting of ammonium salts, amides, imides, and amine-containing compounds,

wherein at least one mol of the selective non-catalytic reducing compound is added per one mol of nitrogen oxide or nitrogen dioxide produced upon combustion of said gas generant composition.

35. (previously presented) The vehicle occupant restraint system of claim 34 wherein said gas generant composition is extruded into a desirable shape and upon combustion

yields gases comprising  $\text{NO}_x$  gas, and, said reducing compound contains at least one mole of elemental nitrogen per one mole of  $\text{NO}_x$  produced by the gas generant composition upon combustion and is discretely interspersed about the gas generant composition.

36. (previously presented) The vehicle occupant restraint system of claim 34 wherein said gas generant composition comprises at least one material of each of the following functional groups of materials – a) a fuel selected from the group of azole compounds consisting of triazole, aminotetrazole, tetrazole, bitetrazole, and metal salts of these compounds; b) an oxygen containing oxidizer compound selected from the group consisting of alkali metal, alkaline earth metal, lanthanide and ammonium nitrates and perchlorates or from the group consisting of alkali metal and alkaline earth metal chlorates and peroxides; and c) a low-temperature slag forming material which is sufficient in amount during combustion to cause the solid combustion particles to coalesce into easily filterable slag or clinkers but not so much as to make a low viscosity liquid, selected from the group consisting of silicon dioxide, boric oxide and vanadium pentoxide or from the group consisting of alkali metal silicates, borates, and carbonates or from the group consisting of naturally occurring clays and talcs, and, the gas generant composition is extruded into a desirable shape and combusts to yield gases comprising  $\text{NO}_x$  gases, and, the reducing compound contains at least one mole of elemental nitrogen per one mole of  $\text{NO}_x$  produced by the gas generating mixture upon combustion, and is interspersed about the gas generant composition.

37. (previously presented) The vehicle occupant restraint system of claim 34 wherein said nitrogen-containing gas generant composition produces nitrogen oxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or

nitrogen dioxide produced from combustion of said gas generant composition.

38. (previously presented) The vehicle occupant restraint system of claim 35 wherein said nitrogen-containing gas generant composition produces nitrogen oxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

39. (previously presented) The vehicle occupant restraint system of claim 36 wherein said nitrogen-containing gas generant composition produces nitrogen oxide and/or nitrogen dioxide upon combustion thereof and said selective non-catalytic reducing compound is proximate to and heterogeneously interspersed about said gas generant composition, whereby said reducing compound reduces the nitrogen monoxide and/or nitrogen dioxide produced from combustion of said gas generant composition.

40. (previously presented) A vehicle occupant restraint system of Claim 34 wherein:  
said selective non-catalytic reducing compound is selected from the group  
consisting of ammonium carbonate  $((\text{NH}_4)_2\text{CO}_3)$ , ammonium sulfate  
 $((\text{NH}_4)_2\text{SO}_4)$ , ammonium chloride  $(\text{NH}_4\text{Cl})$ , ammonium carbamate  
 $(\text{H}_2\text{NCO}_2\text{NH}_4)$ , and ammonium fluoride  $(\text{NH}_4\text{F})$ .

41. (previously presented) The vehicle occupant restraint system of claim 21 wherein said selective non-catalytic reducing compound is ammonium sulfate.

42. (previously presented) The vehicle occupant restraint system of claim 23 wherein said selective non-catalytic reducing compound is ammonium sulfate.

43. (previously presented) The vehicle occupant restraint system of claim 25 wherein the gas generant composition is a nonazide gas generant composition and the selective non-catalytic reducing compound is ammonium sulfate.
44. (previously presented) The vehicle occupant restraint system of claim 27 wherein the gas generant composition is a nonazide gas generant composition and the selective non-catalytic reducing compound is ammonium sulfate.
45. (previously presented) The vehicle occupant restraint system of claim 29 wherein said selective non-catalytic reducing compound is ammonium sulfate.
46. (previously presented) The vehicle occupant restraint system of claim 31 wherein said gas generant composition is a nonazide composition and said selective non-catalytic reducing compound is ammonium sulfate.
47. (previously presented) The vehicle occupant restraint system of Claim 31 wherein: said selective non-catalytic reducing compound is selected from the group consisting of ammonium carbonate  $((\text{NH}_4)_2\text{CO}_3)$ , ammonium sulfate  $((\text{NH}_4)_2\text{SO}_4)$ , ammonium chloride  $(\text{NH}_4\text{Cl})$ , ammonium carbamate  $(\text{H}_2\text{NCO}_2\text{NH}_4)$ , and ammonium fluoride  $(\text{NH}_4\text{F})$ .

**REMARKS**

Claims 21, 23, 25, 27, 29, 31, and 34-47 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Poole '588 in view of Pacanowsky '514. Applicants reiterate that neither reference when taken alone or in combination with the other, describes or suggests a discrete SNCR agent, ammonium sulfate, and a separate gas generant composition. Poole has been commented on in past office action responses, and the same arguments are herein incorporated by reference as if fully stated herein.

In sum, Poole '588 describes compositions that mitigate the formation of NO<sub>x</sub>. Accordingly, nothing in Poole would motivate one of ordinary skill in the art to add a selective non-catalytic reducing (SNCR) agent to further remove NO<sub>x</sub>, for the compositions according to Poole are sufficiently formulated to provide optimum amounts of NO<sub>x</sub>. In essence, Poole does not describe or teach the necessity of removing NO<sub>x</sub> from the compositions of that invention, for the compositions described result in acceptable levels of NO<sub>x</sub>. Note that Poole describes the use of an alkali metal salt mixed within the composition. This is not akin to heterogeneous or separate relationship of the SNCR agent to the gas generant composition as claimed throughout the claims. See column 8, lines 39-47 of '588. No other method of reducing NO<sub>x</sub> is described or suggested, and therefore the requisite showing that one of ordinary skill in the art would be motivated to combine Poole and Pacanowsky has not been met. Poole describes his solution at column 8, lines 39-47, and therefore, no other solution would be suggested or required. Accordingly, a prima facie case of obviousness is not supported.

Even if Poole discussed the need for NO<sub>x</sub> removal from the compositions described therein, or suggested the need for further NO<sub>x</sub> removal (which Poole does not), Pacanowsky does not describe the use of ammonium sulfate as a discrete nitrogen reducing compound, but instead describes the use of ammonium sulfate mixed within a composition, thereby attenuating the affects of acceleration. It should further be

emphasized that Pacanowsky does not teach interspersing of the SNCR agent about the gas generant composition. Instead, Pacanowsky teaches an intimate mixture of all of the ingredients of the gas generant composition. The Examiner's attention is directed to Column 4, line 63 through Column 5, line 12, where an intimate mixture of ammonium sulfate and a gas generant composition are described. Contrary to the Examiner's assertion, Pacanowsky does not teach interspersal of the SNCR agent about the gas generant composition as stated by the Examiner on pages 3 and 4 of the final rejection. The Examiner in fact seems to say just the opposite in the "Response to the Arguments" section beginning on page 4: "Pacanowsky does not describe the use of ammonium sulfate as a discrete nitrogen compound but instead within the composition which would attenuate the affects of acceleration". As such, Pacanowsky does not describe nor suggest the claims as presently claimed.

In sum, neither reference when taken alone or in combination describes or suggests all of the limitations of the claims as presently claimed. Without that, a prima facie case of obviousness has not been made. Furthermore, for the sake of argument only, even if the limitations of the present claims were found in the references, the requisite showing of a motivation to combine the references has not been met. Anything other than the suggestion within the references amounts to nothing more than impermissible hindsight reconstruction of the claims. On this basis as well, a prima facie case of obviousness is simply not supported.

Accordingly, Applicants courteously request reconsideration of the standing rejections, allowance of the pending claims, and passage of the application to issue.

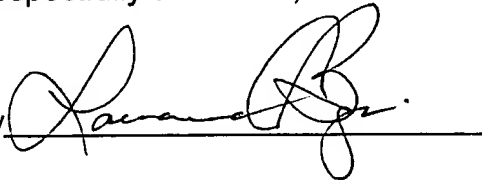


Applicants have calculated no additional fee to be due in connection with this paper. The Commissioner is authorized to charge any deficiencies or credit any overage to Deposit Account No. 50-3238. If the Applicants can be of any further assistance, the examiner is invited to contact the undersigned at the number given below.

Date 12/26/06

L.C. Begin & Associates, PLLC  
510 Highland Avenue  
PMB 403  
Milford, Michigan 48381-1586

Respectfully submitted,

By 

Laurence C. Begin  
Reg. No. 42310  
Phone (248) 889-5875  
FAX (248) 887-7664

## **Appendix K**

**Advisory Action Dated 1/17/07**



# UNITED STATES PATENT AND TRADEMARK OFFICE

JAN 19 2007

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

09/638,606

08/15/2000

Sean P. Burns

GIO-007-US

1629

7590 01/17/2007  
L.C. BEGIN & ASSOCIATES, PLLC.  
510 HIGHLAND AVENUE  
PMB 403  
MILFORD, MI 48381-1586

EXAMINER

GELLNER, JEFFREY L

ART UNIT

PAPER NUMBER

3643

MAIL DATE

DELIVERY MODE

01/17/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

**Advisory Action  
Before the Filing of an Appeal Brief**

Application No.

09/638,606

Applicant(s)

BURNS ET AL.

Examiner

Jeffrey L. Gellner

Art Unit

3643

**--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

THE REPLY FILED 26 December 2006 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

1. ☒ The reply was filed after a final rejection, but prior to or on the same day as filing a Notice of Appeal. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114. The reply must be filed within one of the following time periods:

- a) ☒ The period for reply expires 3 months from the mailing date of the final rejection.  
b) ☐ The period for reply expires on: (1) the mailing date of this Advisory Action, or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.  
Examiner Note: If box 1 is checked, check either box (a) or (b). ONLY CHECK BOX (b) WHEN THE FIRST REPLY WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**NOTICE OF APPEAL**

2. ☐ The Notice of Appeal was filed on \_\_\_\_\_. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

**AMENDMENTS**

3. ☐ The proposed amendment(s) filed after a final rejection, but prior to the date of filing a brief, will not be entered because  
(a) ☐ They raise new issues that would require further consideration and/or search (see NOTE below);  
(b) ☐ They raise the issue of new matter (see NOTE below);  
(c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or  
(d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.

NOTE: \_\_\_\_\_. (See 37 CFR 1.116 and 41.33(a)).

4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).  
5. ☐ Applicant's reply has overcome the following rejection(s): \_\_\_\_\_.  
6. ☐ Newly proposed or amended claim(s) \_\_\_\_\_ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).  
7. ☐ For purposes of appeal, the proposed amendment(s): a) ☐ will not be entered, or b) ☐ will be entered and an explanation of how the new or amended claims would be rejected is provided below or appended.  
The status of the claim(s) is (or will be) as follows:  
Claim(s) allowed: \_\_\_\_\_.  
Claim(s) objected to: \_\_\_\_\_.  
Claim(s) rejected: \_\_\_\_\_.  
Claim(s) withdrawn from consideration: \_\_\_\_\_.

**AFFIDAVIT OR OTHER EVIDENCE**

8. ☐ The affidavit or other evidence filed after a final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).  
9. ☐ The affidavit or other evidence filed after the date of filing a Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of a good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).  
10. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

**REQUEST FOR RECONSIDERATION/OTHER**

11. ☒ The request for reconsideration has been considered but does NOT place the application in condition for allowance because:  
See Continuation Sheet.  
12. ☐ Note the attached Information Disclosure Statement(s). (PTO/SB/08) Paper No(s). \_\_\_\_\_.  
13. ☐ Other: \_\_\_\_\_.

Jeffrey L. Gellner  
Primary Examiner  
Art Unit: 3643

Continuation of 11. does NOT place the application in condition for allowance because: Pacanowsky et al. discloses the use of ammonium sulfate to decrease the effect of compression and to act as a coolant. Ammonium sulfate would also act as an SNCR agent when in a composition. Further, Pacanowsky et al. discloses that the mixing time may vary (col. 5 lines 1-5). When mixing time is short the composition would not be uniformly mixed, hence, the ammonium sulfate would be heterogeneous in relation to the other constituents in the composition.

# **Appendix L**

**Notice of Appeal Filed 1/25/07**